# HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS



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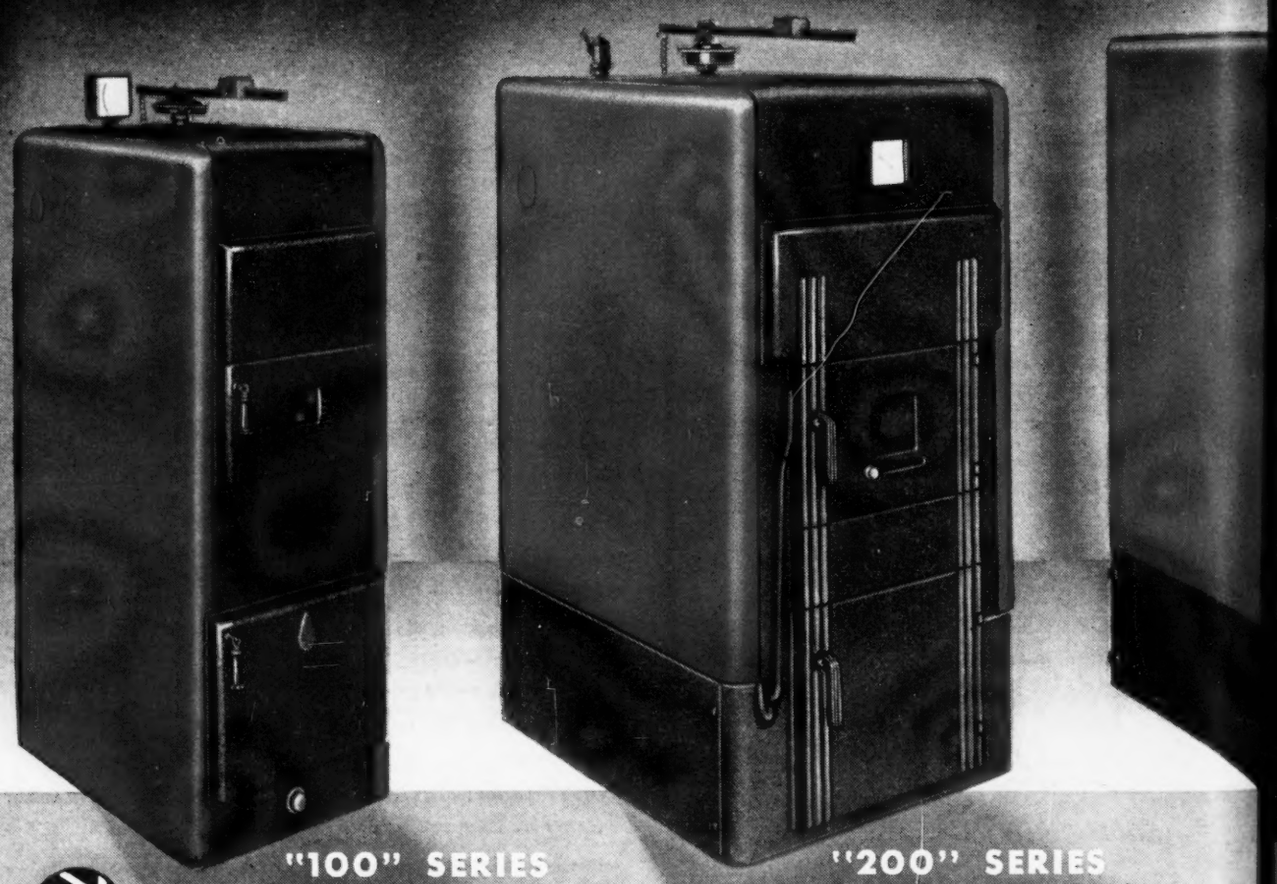
## THIS MONTH

A discussion of various factors influencing performance of the mechanical draft cooling tower, with curves and data for estimating performance begins on page 73.

A NEW, STILL BETTER GENERATION

# The Complete Line of NATIONAL HEAT EXTRACTORS

## for coal, oil or gas firing



**"100" SERIES**
Smart and compact for small home installation in kitchen, basement or utility room.

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Big boiler performance for homes of medium size and some commercial installations.

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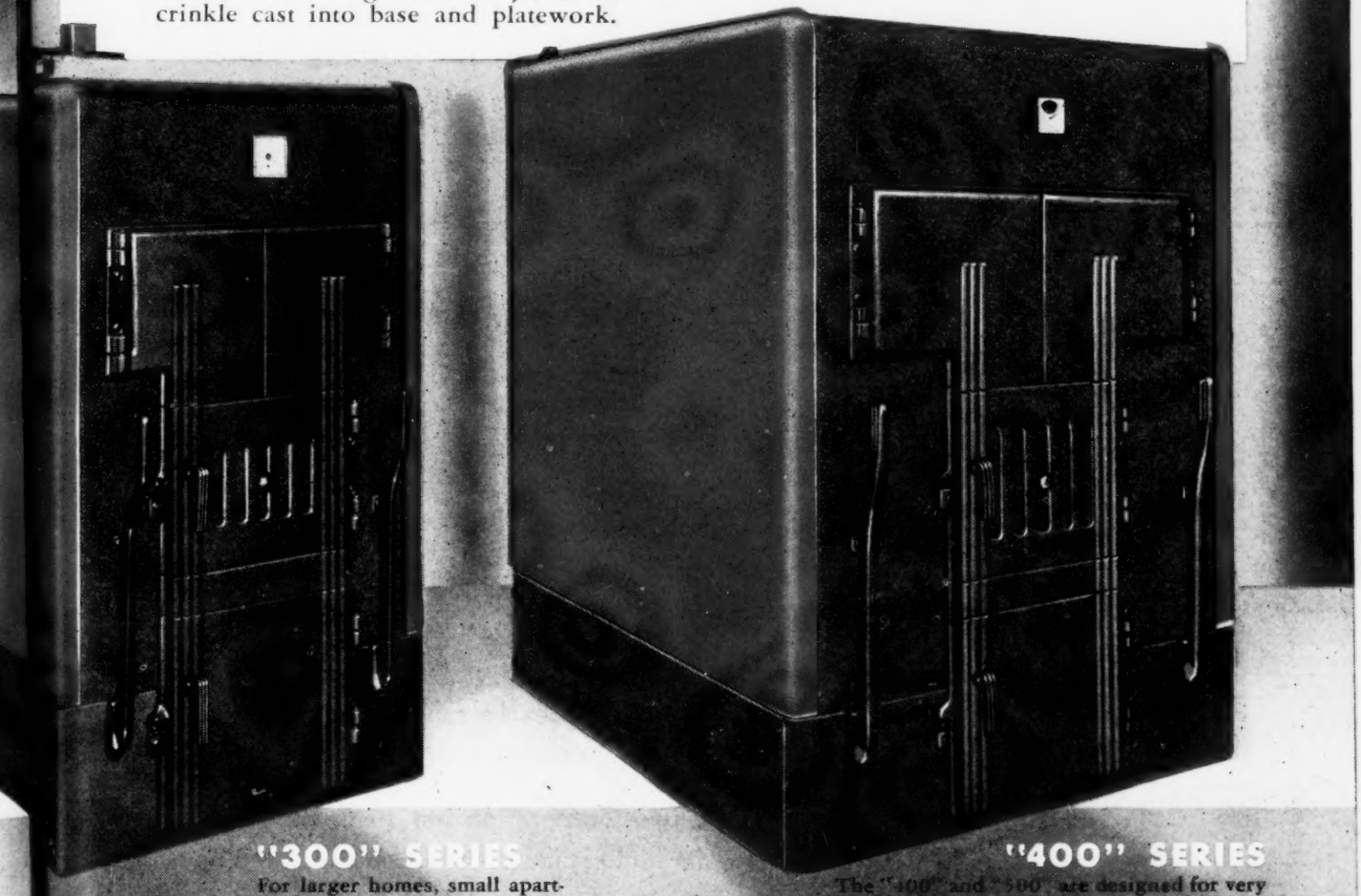

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For larger homes, small apartments and various commercial installations where more heat is needed.

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The "400" and "500" are designed for very large installations where plenty of heat is required to serve many purposes. Characteristic HEAT EXTRACTOR construction.

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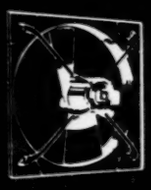

Herman Nelson Direct Drive Propeller Fans

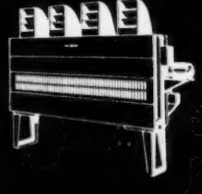
Herman Nelson Belt Drive Propeller Fans

Herman Nelson Horizontal Shaft Propeller-Fan Type Unit Heaters

Herman Nelson Type H Centrifugal Fans

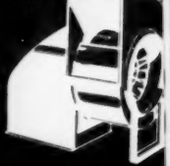
Herman Nelson Vertical Shaft Propeller-Fan Type Unit Heaters

Herman Nelson Type HB Centrifugal Fans


Herman Nelson Blower-Fan Type Unit Heaters

Herman Nelson DeLuxe Unit Heaters

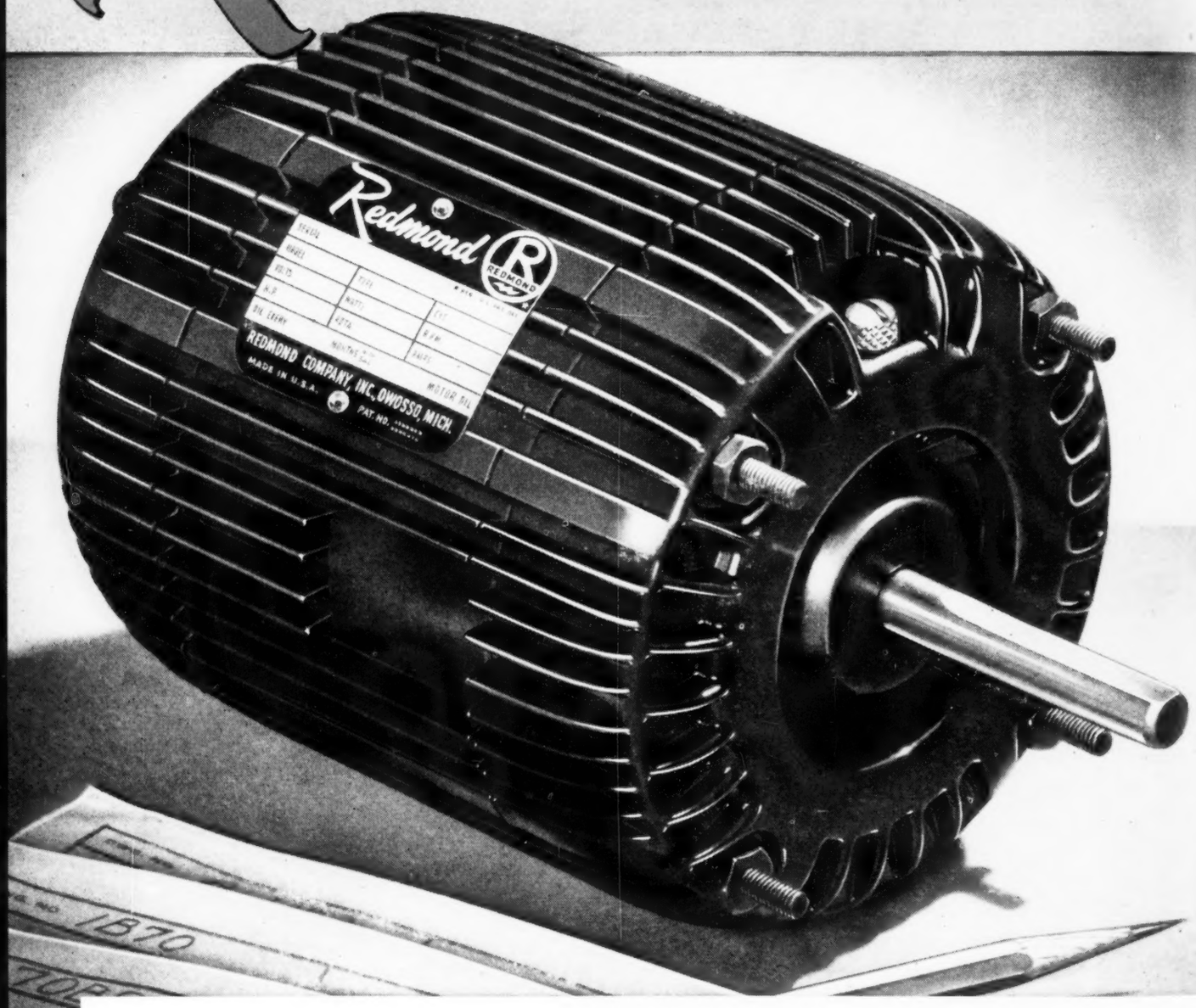
Herman Nelson Unit Ventilators

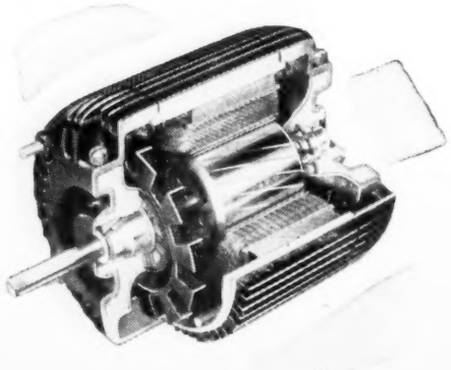

Herman Nelson Belt Drive Unit Blowers

Herman Nelson Direct Drive Unit Blowers

# NEW 1/20th HORSEPOWER

# Redmond



## You Get ALL THESE FEATURES In The Type "U"

- ★ Full 1/20 HP. at 1500 R. P. M.
- ★ Totally enclosed 4-pole shaded pole
- ★ 2 sq. inches bearing surfaces
- ★ Bearings spaced 5 inches overall
- ★ Individually fitted bearings
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- ★ Super-Life circulating lubrication
- ★ Operates in any position
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- ★ Flush-Weld precision skewed rotor
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- ★ Sturdy die cast machined frame
- ★ Fin-Line functional styling
- ★ 198 sq. inches cooling surface
- ★ Internal air circulation

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# TYPE "U"

*For A.C. Operation*

STRIKE UP an acquaintance with the neatest number that's come along in many a year.

Especially if you're hankering for twentieth horsepower jobs, you'll want every last detail on the new Redmond Type "U" long-life Micromotor.

The basic design for this new Type "U" was determined by thoroughly checking requirements of the motor-consuming markets. As a result, the Type "U" embodies these desirable key features:

*Shaded pole design,* for speed control and utmost reliability.

*Generous broadly spaced bearings,* for maximum smoothness.

*Super-Life lubrication,* to permit continuous operation for unlimited periods, with Micromotor mounted in any position.

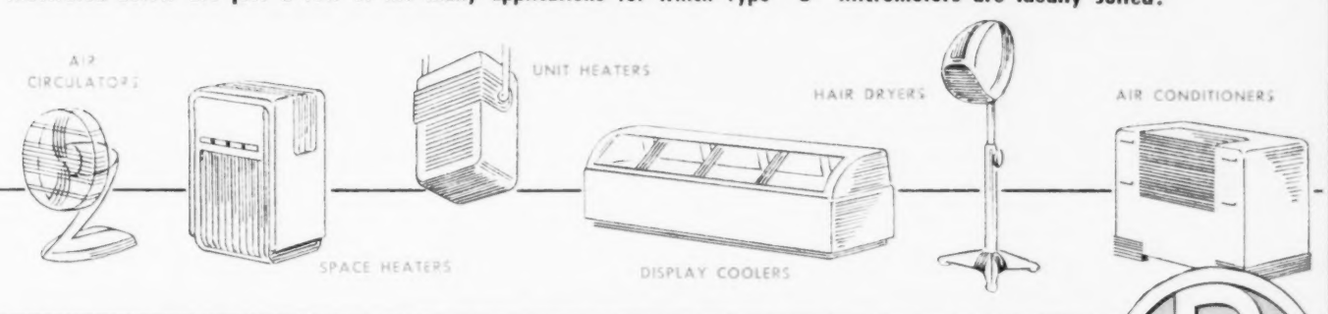
*Sturdy die cast construction,* in modern functional styling.

The Redmond engineers went the whole way. You'll find the Type "U" loaded with remarkable engineering accomplishments.

It's the culmination of years of designing, testing and mass production experience. It's built by the same specialists who have already turned out more than 20,000,000 dependable Redmond Micromotors. It's the kind of motor you'll want.

Phone or drop us a line today. Ask about the Redmond Type "U" Micromotor.

**Illustrated below are just a few of the many applications for which Type "U" Micromotors are ideally suited:**

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Composite view of Redmond plants

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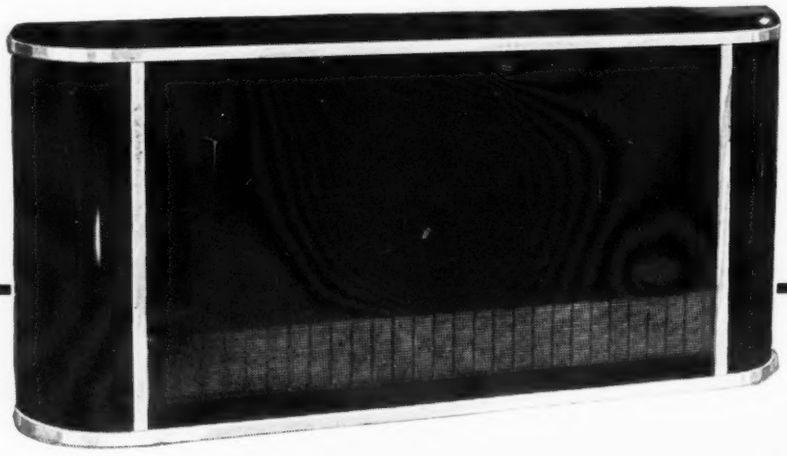
*Unit Ventilator lines are going again at Sturtevant, and production facilities have been stepped up.*

## There's been no compromise with quality

**IN WORKMANSHIP,** you'll find the same high standards of fabrication and assembly that you found in Unit Ventilators before the war. Sturtevant men are proud of their integrity as craftsmen.

**IN MATERIALS,** scarce as they may be, no substitutes have been introduced. You get dependable Sturtevant Super-silent motors and efficient fans, rugged furniture steel cabinets trimmed with gleaming stainless steel. Units are available in solid color, baked enamel finish.

Deluxe model units are now in production for concealed piping arrangements 1, 2 and 4.



# VENTILATORS

## *are in production again!*

IN THE nick of time too. For if you have a new construction or modernization job that must be finished soon—you can specify the finest again—Sturtevant Unit Ventilators.

There's no necessity now, to lay out makeshift heating arrangements for schools and institutional-type buildings. Specification of efficient, dependable Sturtevant Unit Ventilators can be, as before, the reflection of good judgment and wise planning by architects, engineers, and school officials.

### Ask for this booklet...

—catalog 377-2, which contains details of design and construction—capacity and dimension tables—layout suggestions and specification guides. Call your nearest Sturtevant office, or write to: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

Westinghouse

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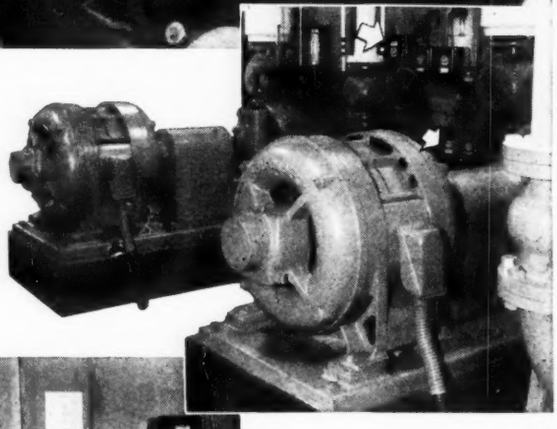
V-80002

# TESTING PILOTS
## at "18,000 ft" and 50 below
### in the Cornell Aeronautical Laboratory Altitude Chamber

Above—Engineers in winter flying equipment recording test data in Cornell Aeronautical Laboratory Altitude Chamber.



Right—View of the equipment room. Note Allen-Bradley motor starters in the background.

## Allen-Bradley Control used throughout

Pilot reactions at high altitudes are easily determined in this modern altitude chamber at the Cornell Aeronautical Laboratory. In this chamber, the low air pressures and low temperatures encountered at high altitudes can be perfectly simulated by pulling a vacuum and by circulating refrigerated air. Motors performing these functions are operated by Allen-Bradley controls.

Allen-Bradley motor starters are so popular in refrigeration and air-conditioning installations because they are so dependable and do not require regular servicing attention. They have only one moving part—there are no pins, pivots, hinges, or bearings to cause trouble, and no flexible conductors to break. Their double break, silver alloy contacts never need maintenance, for any oxides that may form on the contacts are good electrical conductors. Then, too, their extremely simple design automatically eliminates trouble.

Write, Allen-Bradley Co., 1330 S. Second St., Milwaukee 4, Wisconsin.

Above—Control panel in the altitude chamber showing Allen-Bradley motor starters and relays.

Right—Bulletin 709 size 2 across-the-line solenoid starter with cover removed. The white interior reflects light in dark locations for easy installation.

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

# Meeting a "Must" for high heat transfer efficiency

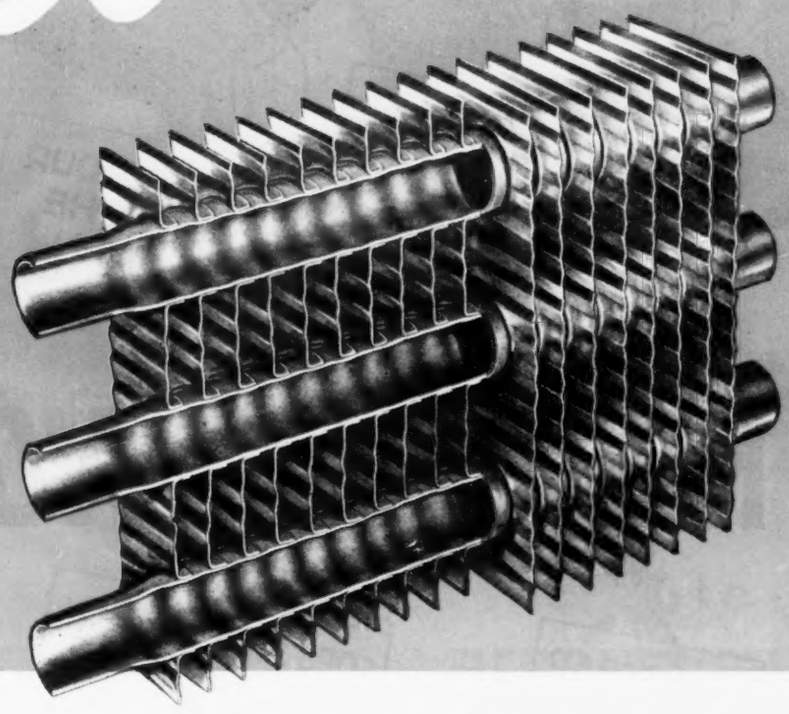
# Contact

McQuay

**RIPPLE FIN COILS**

give you more in

1. **AREA OF CONTACT**
2. **CONSTANCY OF CONTACT**
3. **QUALITY OF CONTACT**



## HYDRAULIC EXPANSION assures top performance!

Three exclusive McQuay methods assure positive contact, high heat transfer efficiency in McQuay Ripple Fin Coils. Wide, spun fin collars put more metal on metal, provide a greater *Area of Contact* for fast, low-loss heat transfer. McQuay's hydraulic expansion method locks fin to tube in a permanent mechanical bond for *Constant Contact* under all operating temperatures. Fin surfaces smoothed by the spinning action of the collar-forming tool permit a more uniform metal-to-metal junction between collar and tube, assure high *Quality of Contact* for maximum heat transfer to the secondary surfaces.

Compact, shockproof McQuay Ripple Fin Coils together with McQuay elliptical copper headers have proved their durability over many years to a wide list of industrial users. Today there are McQuay coils to meet your specifications for steam, hot water, direct expansion, brine and special applications. Call your local McQuay representative or write McQuay, Inc., 1619 Broadway Street N. E., Minneapolis 13.

McQuay INC.

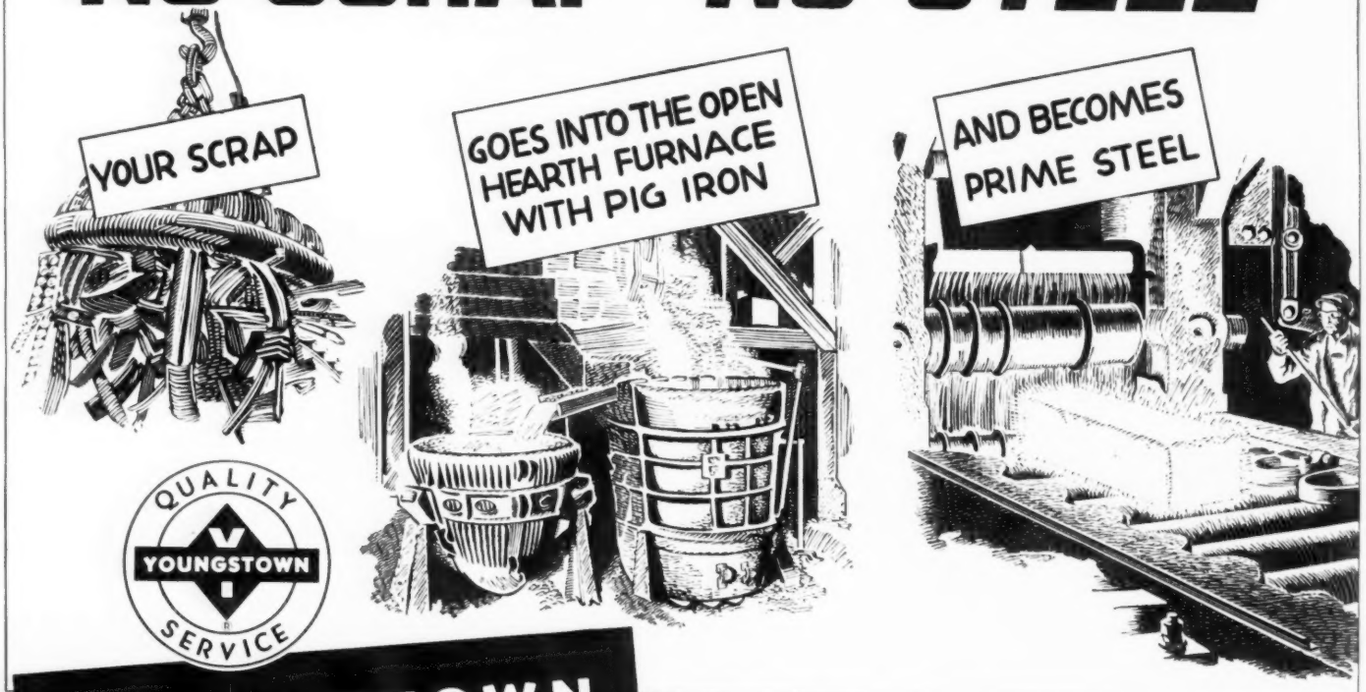
AIR CONDITIONING EQUIPMENT ESPECIALLY DESIGNED FOR INDUSTRY

W N S

MAKE THE SEASONS COME TO YOU

# NO YEAST - *NO BREAD*

# NO SCRAP - *NO STEEL*




QUALITY V YOUNGSTOWN SERVICE

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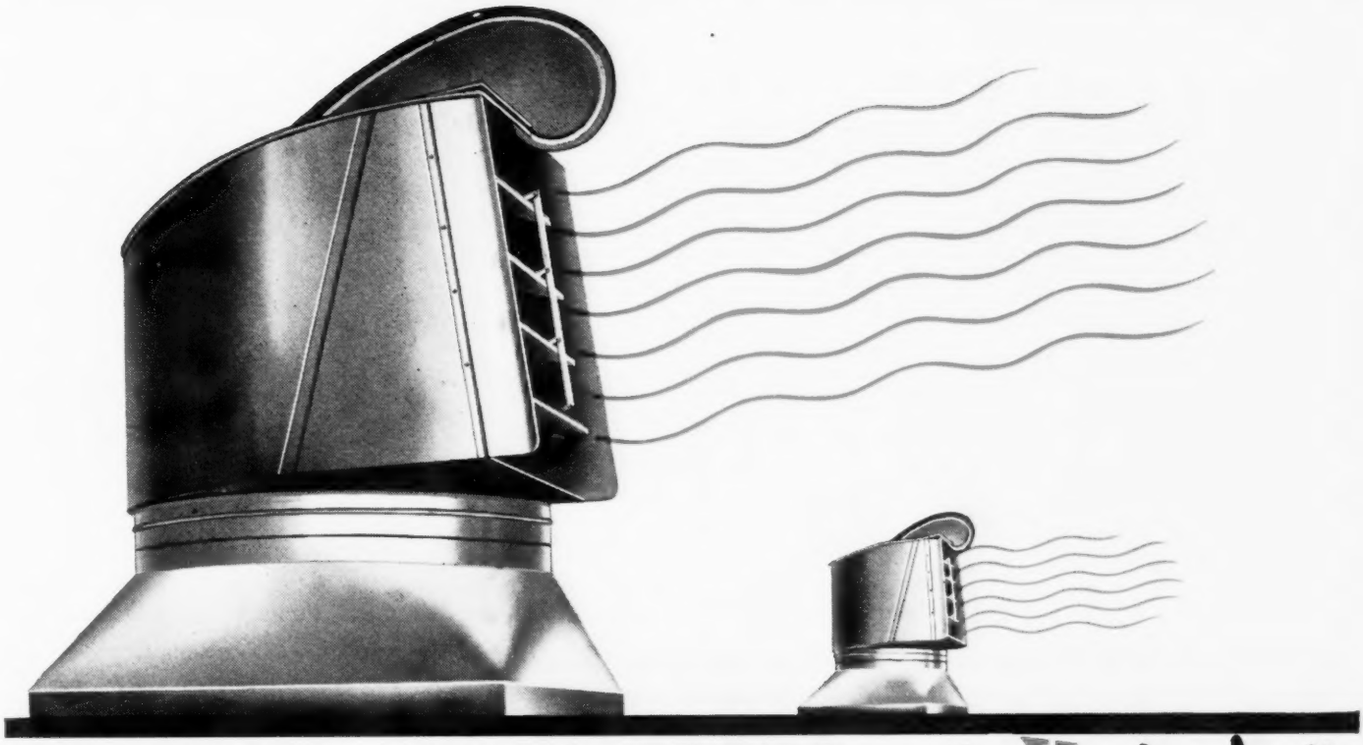
REMEMBER this--It requires large quantities of scrap to produce each ton of prime new steel. So to increase the possibility of making more steel available, turn in your scrap through your regular channels. Do it now! Keep it coming!



# HARTZELL VENTILATORS "on deck"

ONE Hartzell fan-equipped roof ventilator sucks out as much hot, dirty, gas-loaded air as five gravity ventilators of the same size. That means one-fifth as many roof openings for the same ventilation — lower roof maintenance costs — lower installation costs.

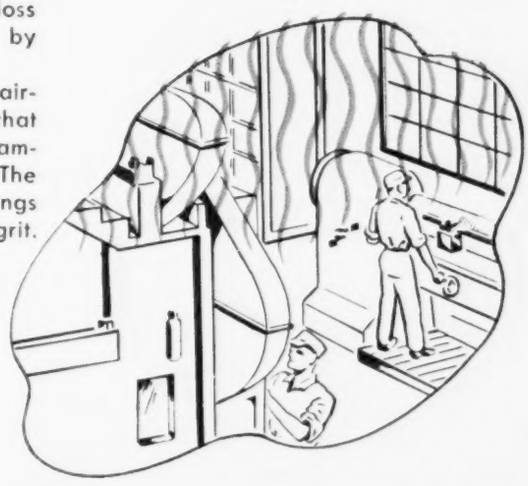
And it means positive, unvarying ventilation, regardless of whether the wind blows or not. It means an end to those hot, muggy, sultry days when production droops, rejections jump and accidents increase. It means maximum production per man-hour, and that's the key to profit.

Why *Hartzell* roof ventilators? Well, the fan is the heart of a forced-draft ventilator, and the Hartzell fan has proved its long-lived economy and air-moving ability to industry over and over again. Blades are designed by the engineers who design the famous Hartzell airplane propellers. They are cast, *not stamped,* for permanent efficiency, and machined to micrometer precision. The exclusive, patented Hartzell Air-Seal Ring practically eliminates loss of air movement at the propeller tips, thereby increasing air delivery by 10% or more.

The housing built around the Hartzell fan carries forward the more-air-per-dollar idea. It is rugged, weather-proof. Its exterior is engineered so that the slightest breeze *adds* to air delivery — *never* retards it. Clean, streamlined interior design presents minimum resistance to the flow of air. The revolving housing turns freely on stainless steel ball bearings. Its bearings never need greasing; they are permanently protected against dirt and grit.

***Send for our Roof Ventilator Bulletin 1902. It has valuable information. And remember, there's a Hartzell field office near you to tell you how much air you need and how to get it at lowest possible cost.***

**increase production below**

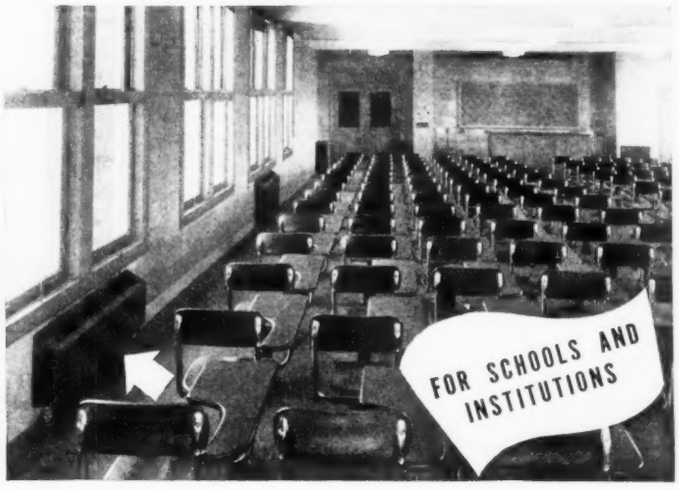


HARTZELL PROPELLER FAN CO.
DIV. OF CASTLE HILLS CORP.
PIQUA, OHIO

C

**PROPELLER-TYPE FANS AND BLOWERS • ROOF VENTILATORS • UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES**

# "STREAMAIRE" CONVECTORS ARE *Growing in Popularity*

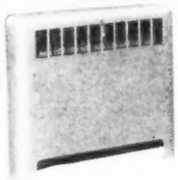



● An increasing number of architects and contractors are specifying "Streamaire" Convectors because they give extras that spell heating satisfaction. "Streamaire" Units are highly efficient and truly economical. They respond instantly to modern thermostatic controls . . . are engineered to circulate warm air by controlled convection, to level off temperature peaks by natural radiation. "Streamaire" Convectors are easy to specify, easy to install because they're standardized in four types, packaged individually to prevent damage. To aid quick identification, cartons are clearly marked with model number and size. "Streamaire" Cabinets, painted to harmonize with any interior, enhance the beauty of modern decorative themes. For convenience, fronts are removable for cleaning.

**SEND FOR FREE CATALOG NO. 4046**

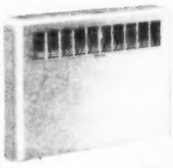
Have you sent for your copy of the new "Streamaire" Convector Catalog? It will give you up-to-date details on the Young line and it includes ratings, specifications and other helpful data.

**FOUR "STREAMAIRE" STYLES MEET EVERY NEED**



◀ FREE STANDING, Type C—Saves on installation costs—no wall recesses are required.

WALL HUNG, Type WS—Sloping top grille prevents careless blocking of air circulation. ▶



◀ WALL HUNG, Type W — Heating element accessible by easily removed one-piece panel.

PARTIALLY RECESSED, Type S—Special "Z" bars permit installation before or after plastering. ▶

# YOUNG

## HEAT TRANSFER PRODUCTS

OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • HEAT EXCHANGERS
INTERCOOLERS • EVAPORATIVE COOLERS ENGINE JACKET WATER COOLERS
GAS COOLERS • UNIT HEATERS CONVECTORS • CONDENSERS • AIR
CONDITIONING UNITS • EVAPORATORS HEATING COILS • COOLING COILS
AND A COMPLETE LINE OF AIRCRAFT HEAT TRANSFER EQUIPMENT

**YOUNG RADIATOR CO., Dept. 107-F RACINE, WIS., U.S.A.**

*Sales and Engineering Offices in All Principal Cities*

# WEIRTON

## COLD-ROLLED STRIP

EXCELLENT DRAWING QUALITIES + GOOD FORMABILITY = VOLUME PRODUCTION

**The use of Weirton cold-rolled strip steel can be a big factor in maintaining high volume at low cost in the making of countless articles or parts. Production is speeded because Weirton strip possesses exceptional drawing and forming qualities. Costs are cut because spoilage and scrap losses and tool expense are reduced. In short, use Weirton cold-rolled strip to promote plant efficiency.**

**Also produced in WEIRZIN Electrolytic Zinc-Coated Cold-Rolled Strip**

**WEIRTON STEEL CO.**

**WEIRTON, W. VA.** *Sales Offices in Principal Cities*

*Division of* **NATIONAL STEEL CORPORATION** *Executive Offices, Pittsburgh, Pa.*

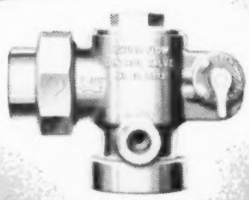
# *It's New!*

## THRUSH
# Ajustaflo

SINGLE MAIN SYSTEM OF

## FORCED HOT WATER HEAT

THRUSH WATER CIRCULATOR



THRUSH FLOW CONTROL VALVE

## THRUSH *Adjustable* TEE
## ONE PIPE FITTING

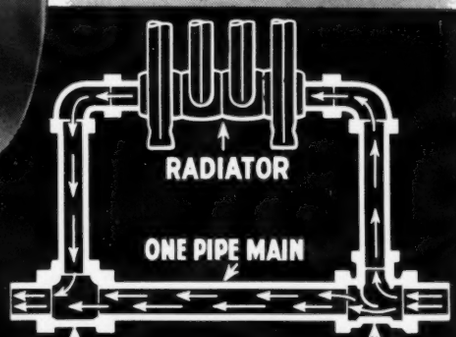
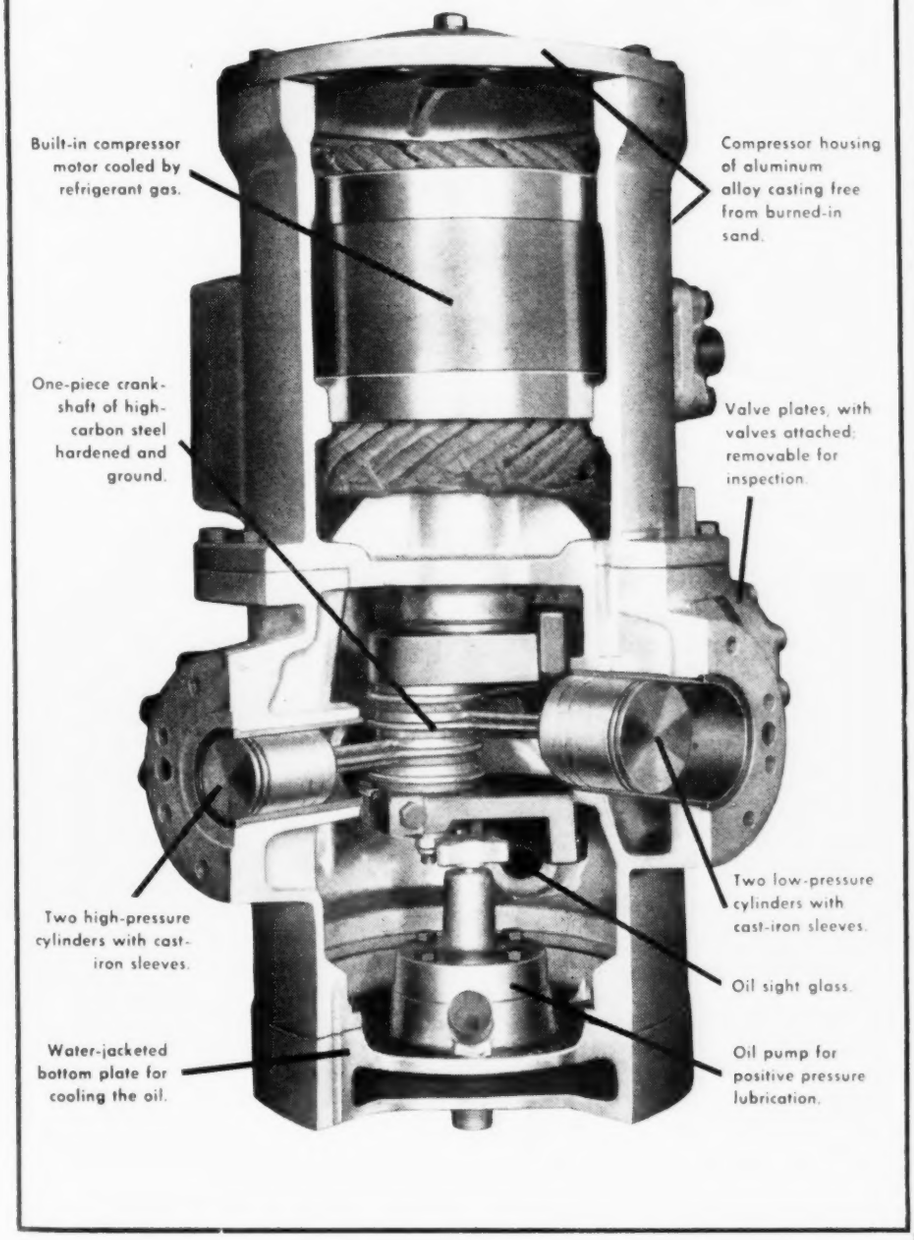



DIAGRAM SHOWING DIVERSION AND FLOW THROUGH MAIN AND RADIATOR

**HERE'S A REAL improvement in the single main method of forced circulating hot water heat. The Thrush Adjustable Tee greatly increases heating efficiency by diverting just the right amount of water to each radiator and simplifies the balancing of the system after installation. The curved diverter in this Tee may be moved to accurately adjust the amount of hot water passing from the main through the radiator, giving control of radiator temperature and making it possible to obtain uniform heat in every room. Flow of water through the main is increased . . . not throttled . . . when branch flow is cut down by this method. For more information, write Department D-6 or see your wholesaler.**

## H. A. THRUSH & COMPANY · PERU, INDIANA

# Gemco's 2-Stage Compressor


Built-in compressor motor cooled by refrigerant gas.
Compressor housing of aluminum alloy casting free from burned-in sand.
One-piece crankshaft of high-carbon steel hardened and ground.
Valve plates, with valves attached; removable for inspection.
Two high-pressure cylinders with cast-iron sleeves.
Two low-pressure cylinders with cast-iron sleeves.
Oil sight glass.
Water-jacketed bottom plate for cooling the oil.
Oil pump for positive pressure lubrication.

## one of the EXCLUSIVE FEATURES that sent other designers hurrying to their drawing boards to try to match GEMCO performance

Gemco's 2-stage Compressor was a sensation when first shown at the Air Conditioning Exposition. And it has been a sensation since Gemco Packaged Air Conditioners went on the market in January.

Production of Gemco Compressors is well ahead of the original schedule. That's one of the reasons why Gemco shipments are setting records for a first-year manufacturer in the air-conditioning field.

Gemco
AIR-CONDITIONING

**General Engineering and Manufacturing Co.**
4417 OLEATHA, ST. LOUIS 16, MO.
Makers of Gemco Precision Shapers and Machine Tools, Gemco Oil Field Equipment, etc.

# NEW HOMES—OLD HOMES

## need heating devices equipped with the revolutionary new "DETROIT" Float Valve

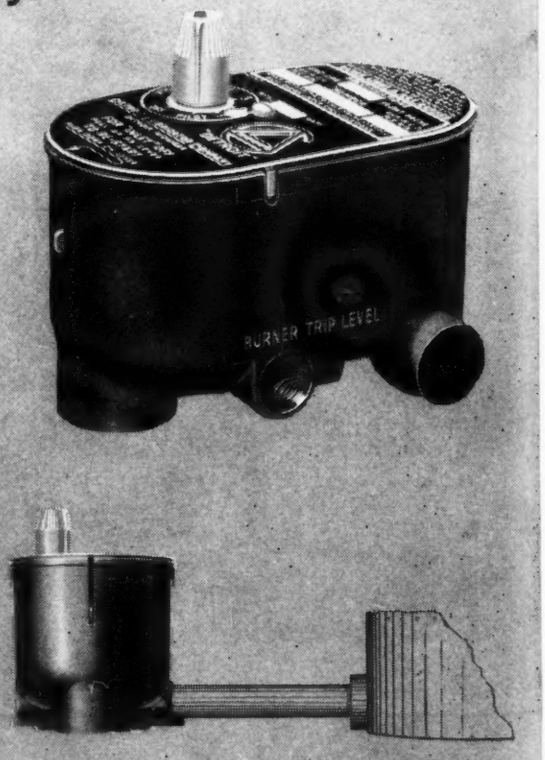
**CRC 246**

ADVANCED IN PRINCIPLE

SIMPLER IN DESIGN

IMPROVED IN APPEARANCE

SUPERIOR IN PERFORMANCE




All the thousands of homes which want improved heating are potential markets for space heaters, water heaters, ranges, furnaces, stoves, equipped with this revolutionary new "Detroit" Float Valve. The CRC 246 is a far superior valve.

**Some of its features are:**

Connects directly to burner nipple. Eliminates tee, fittings, and tubing.

Due to the position of the metering stem, approximately in the center of the assembly, this valve can be tilted a reasonable amount without affecting fuel flow. Leveling by eye is satisfactory. This saves time at assembly and minimizes service calls.

Rate of flow to burner is constant with inlet heads varying from 2 inches to 84 inches. Permits placing bottom of tank flush with top of valve and assures maximum heater output as long as there is fuel in tank. Makes possible design of heaters of less overall height or greater tank capacity. Eliminates "dying fire" when fuel supply is low.

Safety mechanism trips from level of fuel in burner as well as level in valve. Results in less pooling of fuel in burner if fire is extinguished.

Magnetic trip mechanism is positive. Will not trip from vibration.

Low flows are extremely accurate and consistent—a decided advantage for low pilots on water heaters and furnaces. Variations in viscosity have little affect on fuel flow.

Fully temperature-compensated. Uniform fuel flow regardless of temperature assures full heater output at all times.

Smaller size—neat appearance—only two-thirds the size of present valves. Provides greater flexibility in heater design.

Simple to service. Few parts to handle—job takes only a few minutes.

2522

**DETROIT LUBRICATOR COMPANY** *General Offices:* 5900 TRUMBULL AVENUE DETROIT 8, MICHIGAN

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

*Canadian Representatives* — RAILWAY AND ENGINEERING SPECIALTIES LIMITED, MONTREAL, TORONTO, WINNIPEG

"DETROIT"

"Detroit" Heating and Refrigeration Controls • Engine Safety Controls • Safety Float Valves and Oil Burner Accessories • "Detroit" Expansion Valves and Refrigeration Accessories • Stationary and Locomotive Lubricators

# WeldELLS *have everything**

Welded piping is piping at its best. For welding at its best, use the fittings with the *plus-value* features listed here. These features are combined only in WeldELLS.

*** WeldELLS alone combine these features:**

- **Seamless**—greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification markings**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

**TAYLOR FORGE & PIPE WORKS**

**General Offices & Works: P.O. Box 485, Chicago**

**New York Office: 50 Church Street**

**Philadelphia Office: Broad Street Station Bldg.**

**Los Angeles Office: Subway Terminal Bldg.**

# GREET THE PROSPECT WITH CONFIDENCE.....

## *With Petro you're selling more than just a fine oil burner*

When you recommend Petro to your oil burner prospect, you can assure him with confidence that a Petro will live up to *all* his expectations.

Do not hesitate to invite him to investigate Petro — both the *burner* and the *burner-maker.* Encourage him to go as far as he desires. For the more thorough his examination, the more clearly he will see why a Petro can be relied on for low-cost heating performance for many years.

Petro oil burners are the product of experienced engineers, trained craftsmen, modern manufacturing facilities and all the resources of the world's oldest and largest organization devoted exclusively to oil heating.

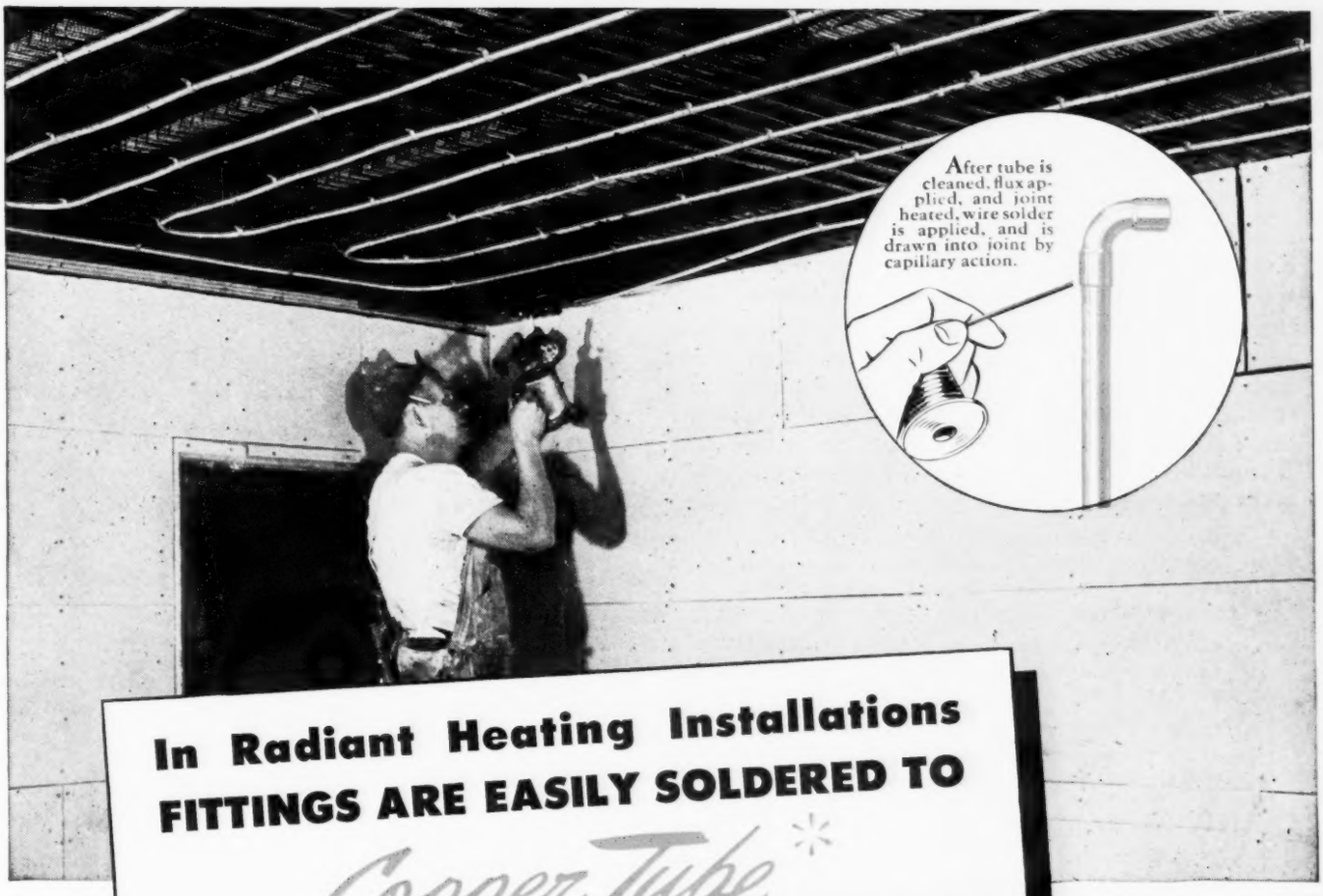
Petro oil burners are obtainable in pressure-atomizing models handling from 1 to 18 gallons per hour of domestic fuel oil. Also in rotary cup models handling from 11 to 145 gallons per hour of heavy commercial-industrial oils. This equipment is distributed through established heating wholesalers. The name of the nearest supply house will be supplied upon request.

**PETRO**
REG. U. S. PAT. OFF.

*MAKERS OF GOOD OIL BURNING EQUIPMENT SINCE 1903*

**PETROLEUM HEAT AND POWER COMPANY · STAMFORD, CONNECTICUT**

Petro Refineries in: CORPUS CHRISTI AND PORT ISABEL, TEXAS. Fuel Oil Bulk Plants and Distribution Terminals in: BOSTON • PROVIDENCE STAMFORD • MT. VERNON • NEW YORK • MINEOLA • BROOKLYN • NEWARK • PHILADELPHIA • BALTIMORE • WASHINGTON • CHICAGO




# In Radiant Heating Installations FITTINGS ARE EASILY SOLDERED TO *Copper Tube*

WHEN Chase Copper Tube is used in radiant heating installations, tight joints are easily made by a simple soldering operation. Both Chase Copper Tube and Chase Solder-type Fittings are made to close tolerances that help assure proper filling of the joint with solder.

Even these easily made joints are needed in only small numbers. Chase Copper Tube comes in lengths up to 100 feet—fewer joints needed between coils. It's easily bent to shape right on the job—no fittings needed at bends. No special tools required for bending, either.

With these and other advantages of Chase Copper Tube (note list at right) it's not surprising that we cannot always keep pace with the demand. But if you're planning radiant heating installations, the information *is* available for your use right now. We'll be glad to send you our radiant heating literature—simply address Dept. HV67.

***7 Reasons***

**WHY CHASE COPPER TUBE FOR RADIANT HEATING**

1. *EASY TO BEND*
2. *LIGHT IN WEIGHT*
3. *SOLDERED FITTINGS*
4. *SMALL DIAMETERS*
5. *LONG LENGTHS*
6. *LOW COST*
7. *LONG LIFE*

# Chase

*the Nation's Headquarters for*
BRASS & COPPER

WATERBURY 91, CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS JACKSONVILLE† KANSAS CITY, MO.† LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON† (†Distributor Sales Office Only)

# One Order to CRANE covers all the Piping Materials

. . . And that goes whether you're installing a boiler or a compressor, a process piping system or a washdown water line. You can get everything from Crane.

It's the *complete* Crane line that saves time in writing specifications . . . in ordering materials . . . and on the installation. It's the line that simplifies piping procedures from design to erection to maintenance. Because it permits standardization on the widest scale . . . and because standardizing on Crane equipment gives you this 3-way advantage:

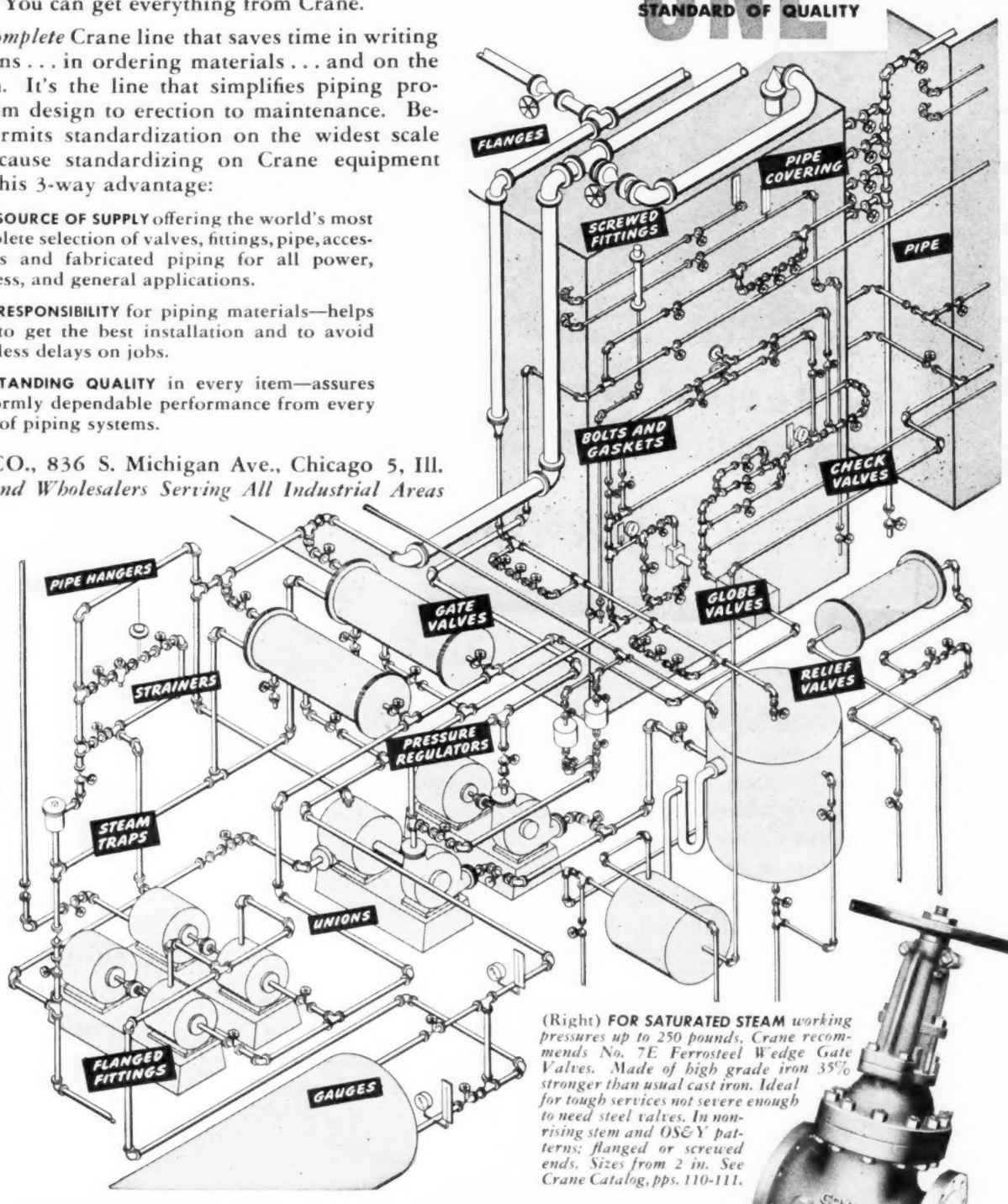
**ONE SOURCE OF SUPPLY** offering the world's most complete selection of valves, fittings, pipe, accessories and fabricated piping for all power, process, and general applications.

**ONE RESPONSIBILITY** for piping materials—helps you to get the best installation and to avoid needless delays on jobs.

**OUTSTANDING QUALITY** in every item—assures uniformly dependable performance from every part of piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*

**ONE**
**SOURCE OF SUPPLY**
**RESPONSIBILITY**
**STANDARD OF QUALITY**




*Fuel, water and condensate piping to oil-burning boilers.*

(Right) **FOR SATURATED STEAM** *working pressures up to 250 pounds, Crane recommends No. 7E Ferrosteel Wedge Gate Valves. Made of high grade iron 35% stronger than usual cast iron. Ideal for tough services not severe enough to need steel valves. In non-rising stem and OS&Y patterns; flanged or screwed ends. Sizes from 2 in. See Crane Catalog, pps. 110-111.*

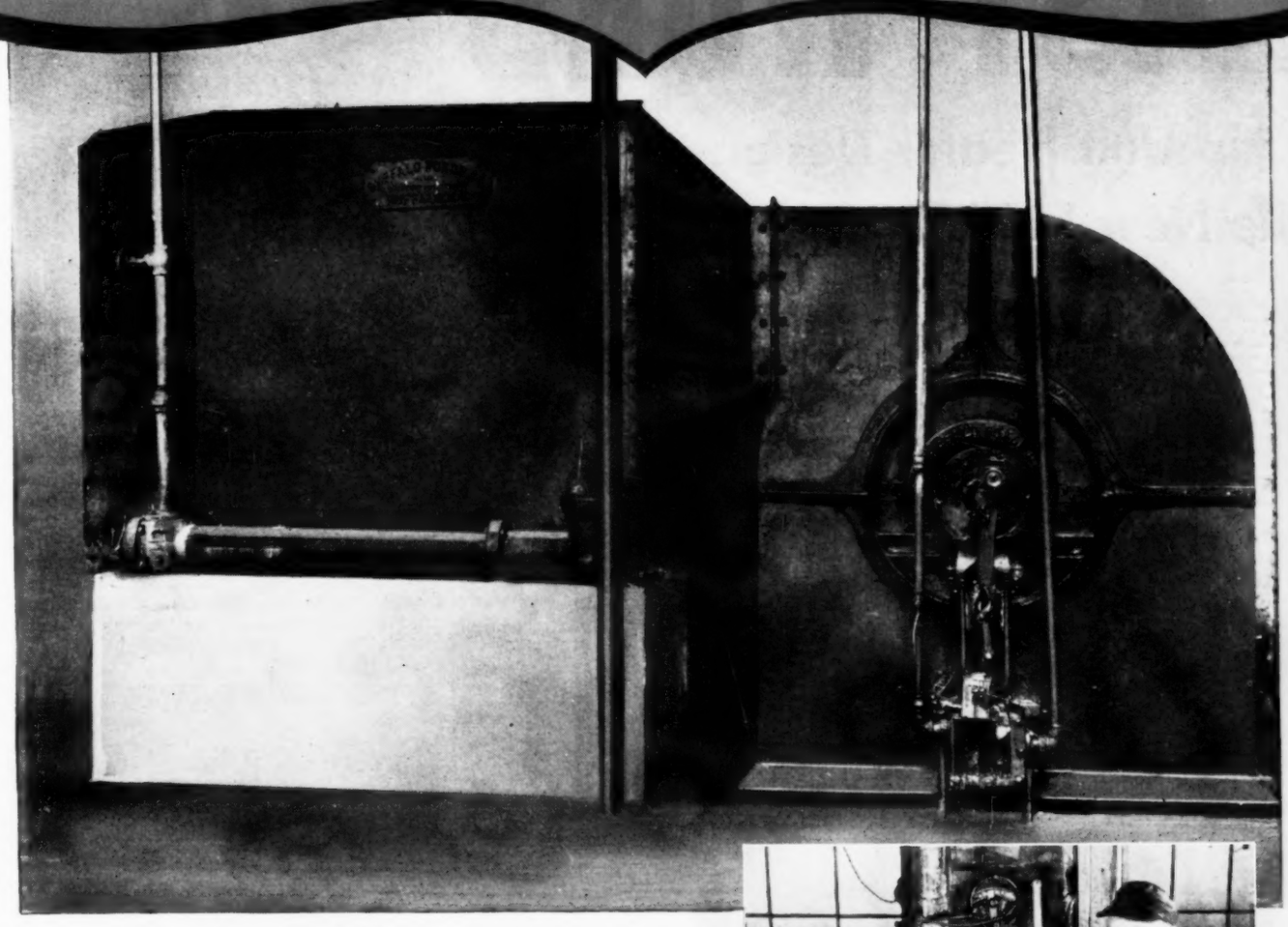
**EVERYTHING FROM . . .**

**VALVES • FITTINGS**
**PIPE • PLUMBING**
**AND HEATING**

# CRANE

**FOR EVERY PIPING SYSTEM**

# 47 YEARS *on the Job!*



## "Buffalo" BIG or LITTLE FANS LAST

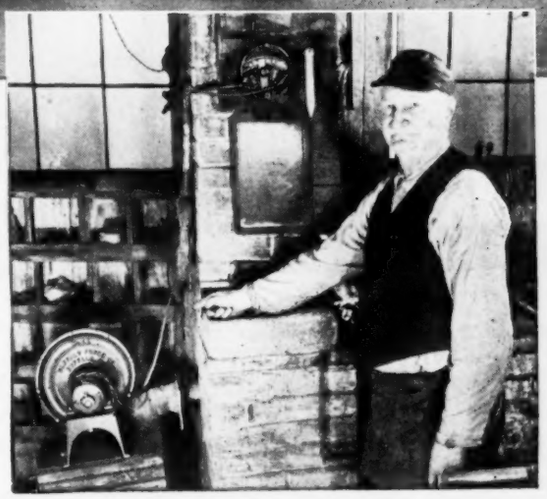
When you invest in a fan, one of the big questions to ask is: *How many years will this investment keep serving?*

The "Buffalo" fan shown above was installed in 1900 . . . and it's still paying "air dividends".

And the many other reports we receive from "Buffalo" fan owners indicate that "Buffalo" installations are practically permanent fixtures in the countless plants, institutions and stores where they serve. Repairs and replacements have been few and far between . . . upkeep and power costs low . . . delivery, high!

Before you invest in a fan, it will pay you to look into the "Buffalo" line. Simply write us stating the air job you have in mind.

**BUFFALO FORGE COMPANY**
480 BROADWAY BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



## *36 Years on the Job!*

"I have been using one of your model 2-E electric Forge blowers for the past 36 years and just this week it has given out, and, from investigation, seems the commutator has failed.

"Have been wondering if there is a possibility of securing another commutator.

"I am a blacksmith by trade, and from the long number of years I have used my present Buffalo Forge Blower, you can see how wonderfully it has performed."

Very truly yours,

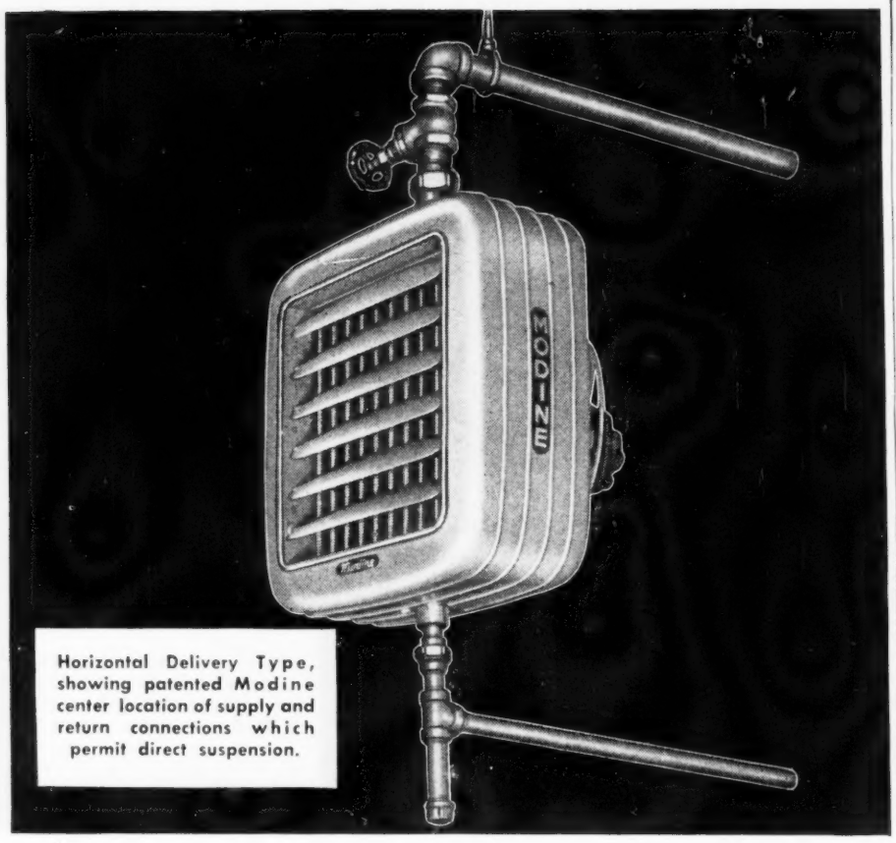
O. P. WARRENDER,
2103 Central Ave.
Anderson, Ind.

"Buffalo" "FIRST FOR FANS"

# FANS for INDUSTRY

# LAST WORD

## in Unit Heater Design...that's the New Modine Unit Heater Line!




Horizontal Delivery Type, showing patented Modine center location of supply and return connections which permit direct suspension.

TODAY'S GREATEST unit heater value — that's what everybody's calling the new 1947 Modine Unit Heater Line! Compare these outstanding Modine features, and we think you'll agree: Beautiful, modern unit heater design, styled for today's and tomorrow's interiors . . . outstanding engineering that gives you improved heating performance combined with fuel economy, low operating and maintenance costs. Yes, never before has propeller unit heater design been so closely adapted to the expanding applications of unit heating, or to the critical requirements of unit heater application engineers!

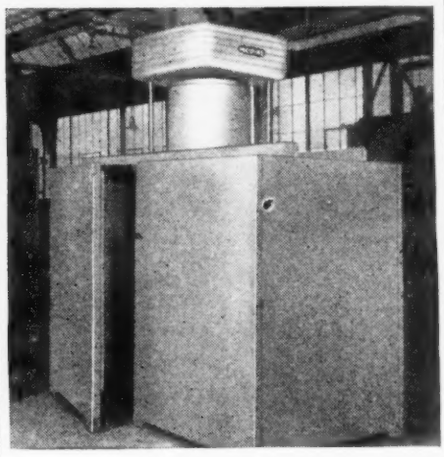
In addition, Modine now gives you a completely integrated unit heater line with *47 basic capacities* for steam and hot water, perfectly coordinated in range of types, sizes, appearance, design and performance: 1) Horizontal Delivery Type for general industrial and commercial applications—2) Vertical Delivery Type for overhead installations — 3) New Power Throw Type for specialized industrial use.

If you're planning to build a new plant or store, investigate the Modine line. For complete information, see the "Where-to-Buy-it" Section of your phone book, or write for free descriptive literature.

**Modine UNIT HEATERS**

## *What's New in Unit Heating?*

**SAVE FLOOR AND WALL SPACE** this easy way! Unit heaters mounted overhead in roof trusses or under ceilings use no floor or wall space that is needed for production or storage purposes. Except for special applications, they require no ducts along walls or floors — no inlet and outlet air grilles . . . no special floor or wall construction. Prime advantage for industrial plants, this feature is an important asset in commercial applications where rents are high and floor space is limited.



**CUT YOUR DRYING COSTS** with a simple drying booth and unit heater! Picture above shows how an efficient drying booth can be constructed of insulating board at minimum expense. Vertical unit heater mounted at top draws in dry room air, heats it and then circulates it rapidly over and around parts to be dried. Air with entrained moisture is dissipated through cracks along lower edges of booth. Doors on front of booth permit bringing in material on pallets.

### Important:

Right now, in the face of material shortages, we are doing our utmost to meet the tremendous demand for Modine Unit Heaters. If there is delay in filling your order, please be patient. When your new Modines are installed, we think you'll agree they were well worth waiting for.

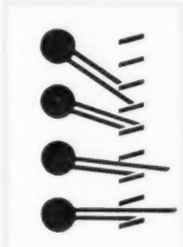
**MODINE MFG. CO.**
1812 Racine Street, Racine, Wisconsin

# Things Go More Smoothly in the Shade!

**PRODUCTION INCREASES, EMPLOYEES WORK BETTER IN ROOMS KEPT COOLER AND SHADED WITH**

## KOOLSHADE® *Sun Screen*

Production lines, office work—and life in general—go along more smoothly in rooms shaded from the heat and glare of direct sunlight. With KoolShade Sun Screen any room is kept cooler, more livable, no matter how hot and scorching the sun. For KoolShade blocks up to 90 percent of the heat-producing sun rays, *outside* the window. It gives complete visibility, lets in plenty of clear, diffused light; will not rust, rot or rattle. Requires no painting, no maintenance; is fire-proof, easy to install, and what is more, makes a perfect insect screen.

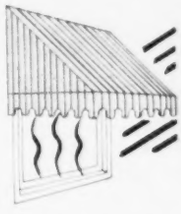


**KoolShade is in effect a miniature venetian blind—its paper-thin bronze "slats" permanently set at the proper angle to block the hot sun rays *outside* the window.**

## KoolShade Proved Most Efficient of All Shading Devices!

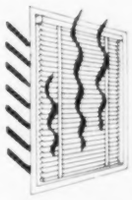
Comparative tests with other shading devices prove conclusively that KoolShade Sun Screen is by far the most effective in cutting temperatures in rooms exposed to the sun. In KoolShade-protected rooms, only 12.5% to 18.2% of sun-ray heat enters the room. That's 81.8% to 87.5% efficiency! And there's still complete visibility and plenty of glareless, diffused light. (Comparative figures from the American Society of Heating and Ventilating Engineers and Pittsburgh Testing Laboratories.)

**CANVAS AWNING**—plain. 28 percent of sun-ray heat enters. Light and visibility much reduced. 72 percent efficiency.

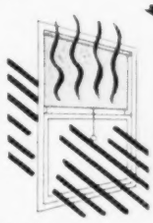


**UNSHADED WINDOW**—100 percent of direct sun-ray heat enters. Affords complete visibility but rates zero in heat-stopping efficiency.

**INSIDE WINDOW SHADE**—buff, half-drawn. 68 percent of sun-ray heat enters. Reduced visibility. 32 percent efficiency.



**INSIDE VENETIAN BLIND**—covering full window, slats at 45 degrees. 58 percent of sun-ray heat enters. Almost no visibility.



**MAIL THIS COUPON TODAY**

Ingersoll Steel Division
Borg-Warner Corp., Dept. C6
310 South Michigan Ave., Chicago 4, Ill.

Please send free sample and literature, also the name of my nearest KoolShade distributor.

Name.....

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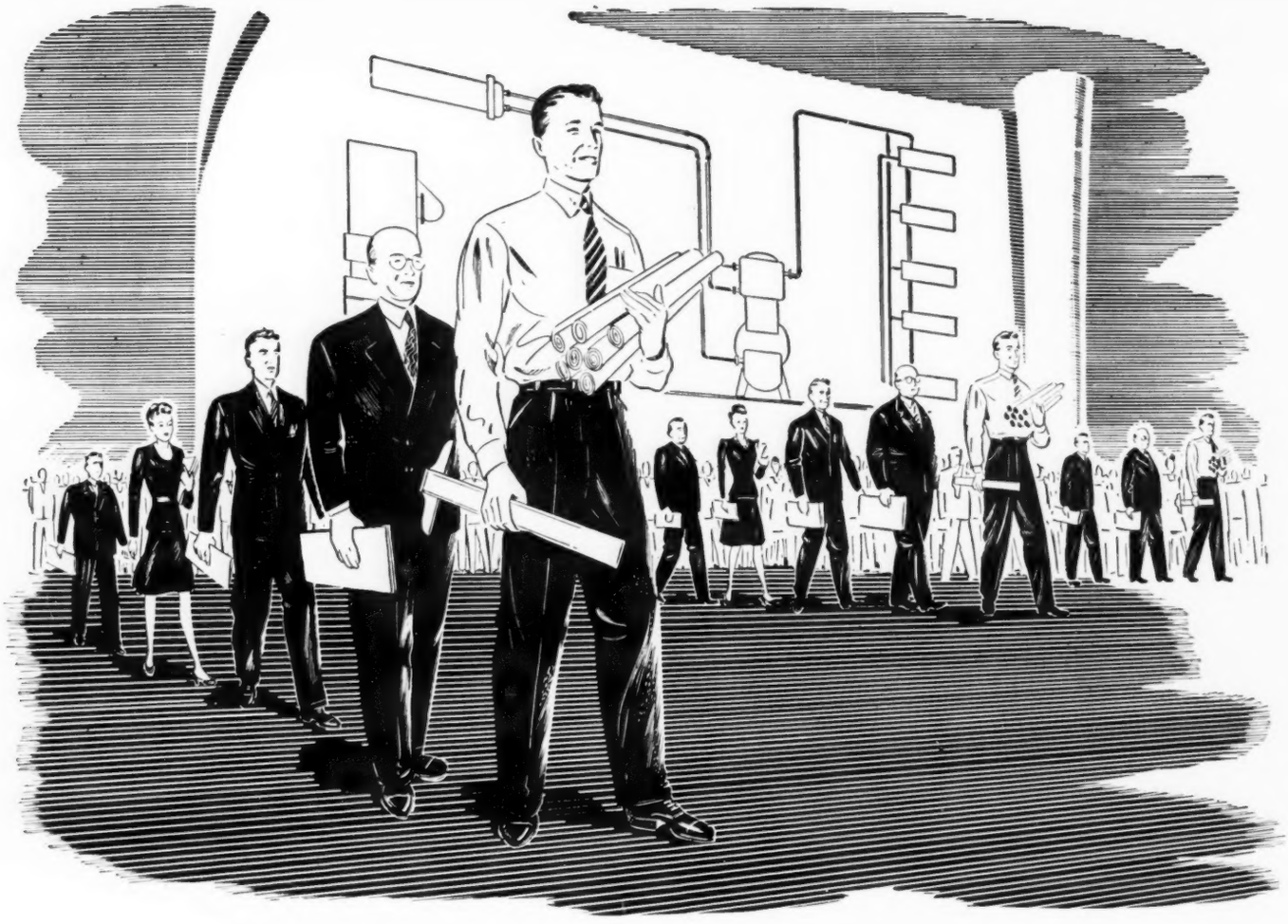
BW PRODUCT OF BORG-WARNER

Ingersoll
**KOOLSHADE® SUN SCREEN**

® Trade Mark Property of INGERSOLL STEEL DIVISION • BORG-WARNER CORPORATION



# IN THE HOUSE OF WEATHER MAGIC . . . ONE OUT OF FIVE IS AN ENGINEER

*One out of every five of the people in the main office of the Trane Company is an engineer.* Considering the number of people required for the duties of accounting, order handling, and the like, the figure is significant. Small wonder that Trane has been called an organization of manufacturing engineers.

Engineering governs every phase of Trane activity . . . from the design, testing, and manufacture of Trane products to cooperation with architects, engineers, and contractors by Trane field engineers. Thus is the phrase Engineered Air Conditioning given meaning in the fullest sense.

Trane heating systems and air conditioning systems are designed by the architect, engineer, or contractor, drawing on the *complete* line of Trane products. Trane field offices in 85 principal cities offer these men their entire cooperation.

* * *

*The Convector-radiator—modern successor to the old-fashioned cast iron radiator—has been engineered by Trane for universal application to steam and hot water heating systems, and is being produced in quantity so you can soon secure it from local distributors' stocks.*

**TRANE**

Manufacturing Engineers of Equipment for
HEATING AND AIR CONDITIONING

THE TRANE COMPANY, LA CROSSE, WISCONSIN • Also TRANE COMPANY OF CANADA, LTD., TORONTO, ONTARIO

# EXPANSION JOINT MAINTENANCE

## 65¢ PER YEAR!

Here's a maintenance record on Yarway Gun-Pakt Expansion Joints that is hard to beat. It was made by a large Southern utility. Over a period of 14 years they purchased 66 Yarway Gun-Pakt Joints. During that time the only maintenance items, aside from labor, have been 42 gals. of lubricating oil and 80 lbs. of special Yarway packing, costing a total of $344.00. Averaged against the service period of each Yarway joint this material maintenance cost comes to $5.40—*or just 65 cents per year per joint!*

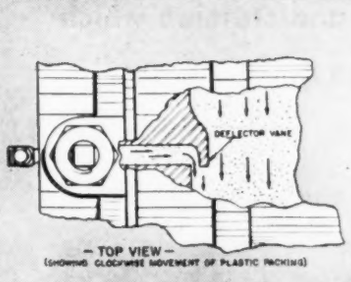
No wonder so many utilities, industrial plants, institutions and public works insist on Yarway Gun-Pakt Expansion Joints — called by many the "greatest expansion joint improvement of modern times."

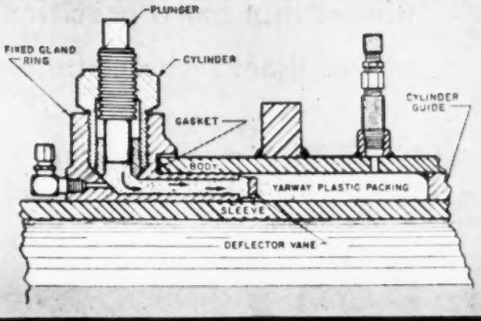
For full information on these modern expansion joints that can be serviced under full steam pressure, write for Bulletin EJ-1911.

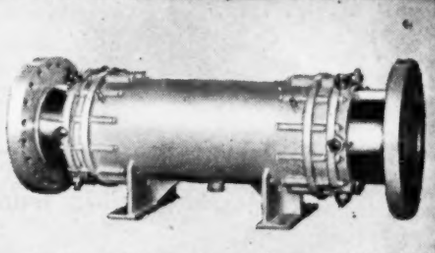
**YARNALL-WARING COMPANY**
**104 Mermaid Ave. Philadelphia 18, Pa.**

SEE YARWAY EXPANSION JOINTS along with other famous Yarway steam plant equipment in the 30-minute color and sound motion picture "There Is An Engineering Reason." Hear Lowell Thomas describe their application. Free for group showings. Write for details.

Maintenance man servicing a typical Yarway Gun-Pakt Joint



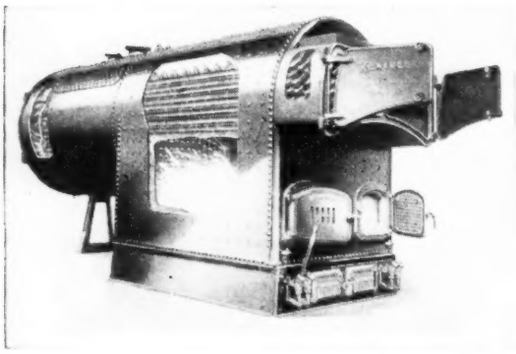
Double end flanged-type Yarway All-Steel Gun-Pakt Joint, 300 lbs. pressure.

**YARWAY GUN-PAKT EXPANSION JOINT**

On these Spacing Machines, operated by skilled boilermakers, rivet holes are "tailored" into heavy steel plate with an accuracy that's really uncanny.

# KEWANEE

## HEAVY DUTY BOILERS



Highly skilled boilermakers . . . working with the most modern equipment in America's finest steel boiler plant . . . "hand tailor" into Kewanee Boilers that extra precision and stamina which makes them such outstanding performers.

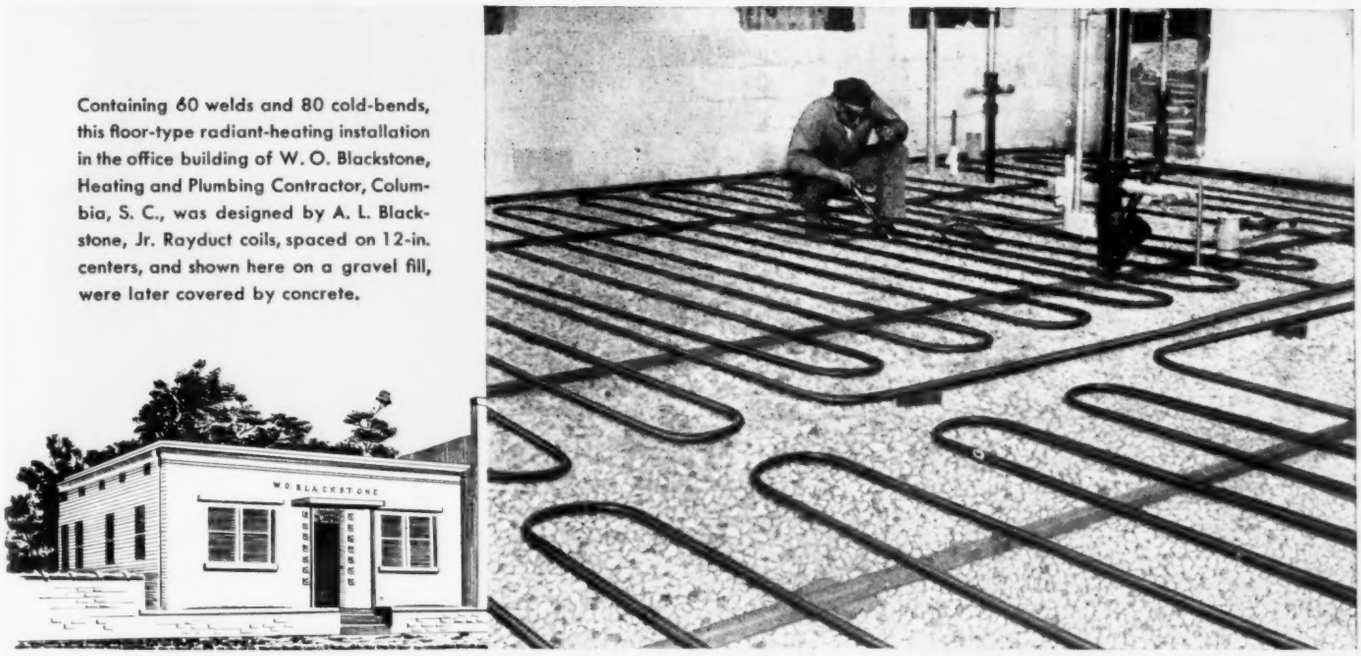
SBI
Reg. U. S. Pat. Off.
MEMBER

*For OIL, GAS, STOKER or Hand Fired*
*Convertible from one fuel to another quickly and easily*

ARMY E NAVY

**KEWANEE BOILER CORPORATION**
**KEWANEE, ILLINOIS**
**Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City 18**
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

OVER 75 YEARS BOILERMAKERS



Containing 60 welds and 80 cold-bends, this floor-type radiant-heating installation in the office building of W. O. Blackstone, Heating and Plumbing Contractor, Columbia, S. C., was designed by A. L. Blackstone, Jr. Rayduct coils, spaced on 12-in. centers, and shown here on a gravel fill, were later covered by concrete.

# WHY YOU'LL LIKE THIS PIPE FOR *Radiant Heating*

Whether radiant-heating designs call for combinations of floor, wall, and ceiling coils or grids . . . bear in mind that *Rayduct is the ideal pipe for the job*. Here are the reasons why you'll like this top-quality pipe.

### *IT'S STRONG AND DUCTILE*

Rayduct is so strong and ductile that it can safely withstand cold-bending, even to centers closer than those called for in radiant heating.

### *EASY TO WELD*

Rayduct is excellent for use in welding radiant-heating units. No special welding technique is required. With Rayduct, even welders with scant experience have little difficulty in making tight, sound welds.

### *CORROSION NO PROBLEM*

In a properly designed closed hot-water radiant-heating system corrosion is of no consequence, as the same water remains in the system at all times, with only negligible quantities of make-up water needed. The slight corrosion that may occur is therefore limited to the neutralization of the initial water in the system.

### *QUICK FABRICATION*

Suppose fittings are called for in radiant heating? Here's where dependable Rayduct again proves its worth, for this sturdy pipe cuts clean, and threads with ease.

### *EXPANDS UNIFORMLY WITH CONCRETE*

With its coefficient of expansion substantially the same as that of concrete and plaster, Rayduct can be embedded in these materials without hesitation.

### *UNIFORM LENGTHS*

Rayduct is furnished in sizes from $\frac{1}{2}$ in. to 3 in., and in uniform 21-ft lengths, plus or minus 1 in. Each length is readily identified by a gold stripe lengthwise on the pipe.

### *LOW IN COST*

Judging it on quality alone, Rayduct belongs in the high-price field, for it's essentially a premium product. But even with all its advantages, Rayduct still sells for the same price as regular steel pipe.

**BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.**

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Rayduct

**for Radiant Heating**

BETHLEHEM STEEL

*Twenty-eight Dravo Counterflo Heaters start their journey from Pittsburgh to the West Coast. They will soon furnish heat for a new, modern automobile assembly plant in Southern California.*

It is no longer necessary for buyers of industrial and commercial heating to take less than the best equipment in order to get prompt shipment.

For open space heating Dravo Counterflo Direct-Fired Heaters are undisputed leaders in quality, efficiency and performance. This is proved through thousands of successful installations.

Now — due to greatly expanded production facilities —
**Dravo Heaters are Available Immediately!**

If you have a heating problem involving 400,000 Btu or more, look up the Dravo distributor in the "Heater Section" of your classified telephone directory —or write or call Heating Section, Dravo Corporation, 300 Penn Avenue, Pittsburgh 22, Pa.

Bulletin BL-516 free on request.

# DRAVO CORPORATION

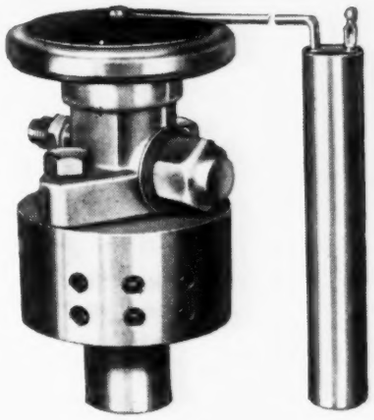
PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT
WASHINGTON · WILMINGTON

# PREVENT COSTLY REFRIGERANT "SHORT-CIRCUITS" WITH ALCO MULTI-OUTLET THERMO VALVES

When poor distribution "short-circuits" the refrigerant through only a few passes, coil capacity is often cut ⅓ to ½ — efficient control is impossible — operating costs climb.

ALCO Multi-Outlet Thermo Valves assure:

- The refrigerant liquid is accurately metered at the point of expansion to all coil circuits
- Even distribution despite load variations
- Full rated coil capacity—every circuit on the job
- Instant, alert control—no "hunting" or "cycling"
- Higher operating suction pressure—more efficient compressor operation at lower cost



Available at your wholesaler's for all refrigerants, all applications: ½ to 50 tons FREON-12, 2 to 36 outlets. Ask for our Bulletin 180.

ALCO

**ALCO VALVE CO.**

859 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

# NIBCO Wrot Fittings OF TODAY

## MAKE COPPER PLUMBING AVAILABLE IN LOW COST HOUSING . . .

HERE'S the amazing story of NIBCO engineering genius and the benefits it has brought to you through twenty years of continuous development and research. When NIBCO introduced copper plumbing in 1928, a ½" Tee weighed 18 ounces and cost 76 cents. Today it weighs only 2 ounces, yet it is stronger, easier to handle and better in many ways . . . and even in an inflated copper market, it still costs less than 20% of the original price! NIBCO WROT Fittings are made by patented processes which assure absolute uniformity with close tolerances accurately maintained. Specify NIBCO WROT Fittings on all jobs. They make stronger joints . . . and every copper installation brings you more business.

NORTHERN INDIANA BRASS COMPANY • ELKHART, INDIANA

**MORE PROFIT · EASIER WORK · BETTER TOO**

*You'll be hearing more about*

# AXIVANE* FANS

**. . . AERODYNAMICALLY DESIGNED TO ASSURE EFFICIENCY**

The air-straightening vanes placed immediately behind the propeller blades on La-Del Fans smooth the flow of air and permit building up high pressures and a uniform, quiet air flow without turbulence. Greater efficiency and economy results, as air can be conveyed faster with less power in La-Del Axivane* designs. Let us show you how La-Del Axivane* Fans can help with your future ventilation problems.

*Quiet Operation*
*Uniform Air Distribution*
*Peak Efficiency*
*No Turbulence*

**LA-DEL FANS**
**TROLLER DESIGNED**

*Trade mark applied for

W&D 1503 rev.

*Consult a Joy Engineer*

***LA-DEL Division***

**JOY MANUFACTURING CO.**

GENERAL OFFICES: HENRY W. OLIVER BUILDING, PITTSBURGH, PA.

Edwards Motor Company, Milwaukee, Wisconsin

# Saved Cost of Stoker First Winter

***One winter's operation paid cost of Iron Fireman stoker for Edwards Motor Company of Milwaukee, Wisconsin***

An Iron Fireman stoker installed 16 years ago in the Edwards Motor Company of Milwaukee, Wisconsin, quickly demonstrated its economy of operation.

"Our first Iron Fireman stoker was installed in our main sales building December 29, 1931. The saving was so substantial that we saved the cost of the stoker the first winter," says George R. Lindblom, President. "Since that time we have continued to add Iron Fireman stoker equipment to other buildings."

## Iron Fireman gets more heat from lower cost coal

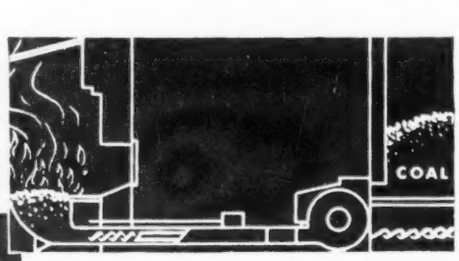
Iron Fireman pays its way in economy and dependability of operation. Fully automatic, it provides steady, uniform heat at lowest cost. You save fuel tonnage through Iron Fireman's highly efficient combustion system which automatically combines fuel and air in correct proportions to get all the heat from even the lower grades of coal. Iron Fireman abates smoke, cuts maintenance costs, increases boiler capacity.

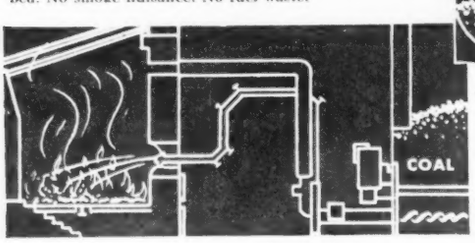
## What about YOUR heating costs?

Iron Fireman technical men will make a thorough survey of your heating plant at no expense or obligation to you. For a free engineering survey or illustrated literature write to Iron Fireman Manufacturing Co., 3130 W. 106th St., Cleveland 11, Ohio. Other plants: Portland, Oregon and Toronto, Canada. Dealers everywhere.

**IRON FIREMAN UNDERFEED STOKER**

The Iron Fireman Underfeed stoker (*right*) provides automatic bunker-to-fire feed for heating and power boilers. The feed worm forces coal upward, under the fire. Coal is slowly heated, the gases thus released passing upward through the fire, where they are burned. Coked coal is burned when it reaches the incandescent fuel bed. No smoke nuisance. No fuel waste.




**IRON FIREMAN PNEUMATIC SPREADER STOKER**

(*Above*). Steam size coal is metered from hopper or main coal bunker and transferred by pneumatic conveyor to furnace. Conveyor nozzle accurately spreads larger particles of coal over entire grate in a shallow, uniform fuel bed. Preheated fines burn in suspension, reducing cinder carry-over and greatly improving combustion efficiency and responsiveness, as compared with stokers which do not preheat coal.

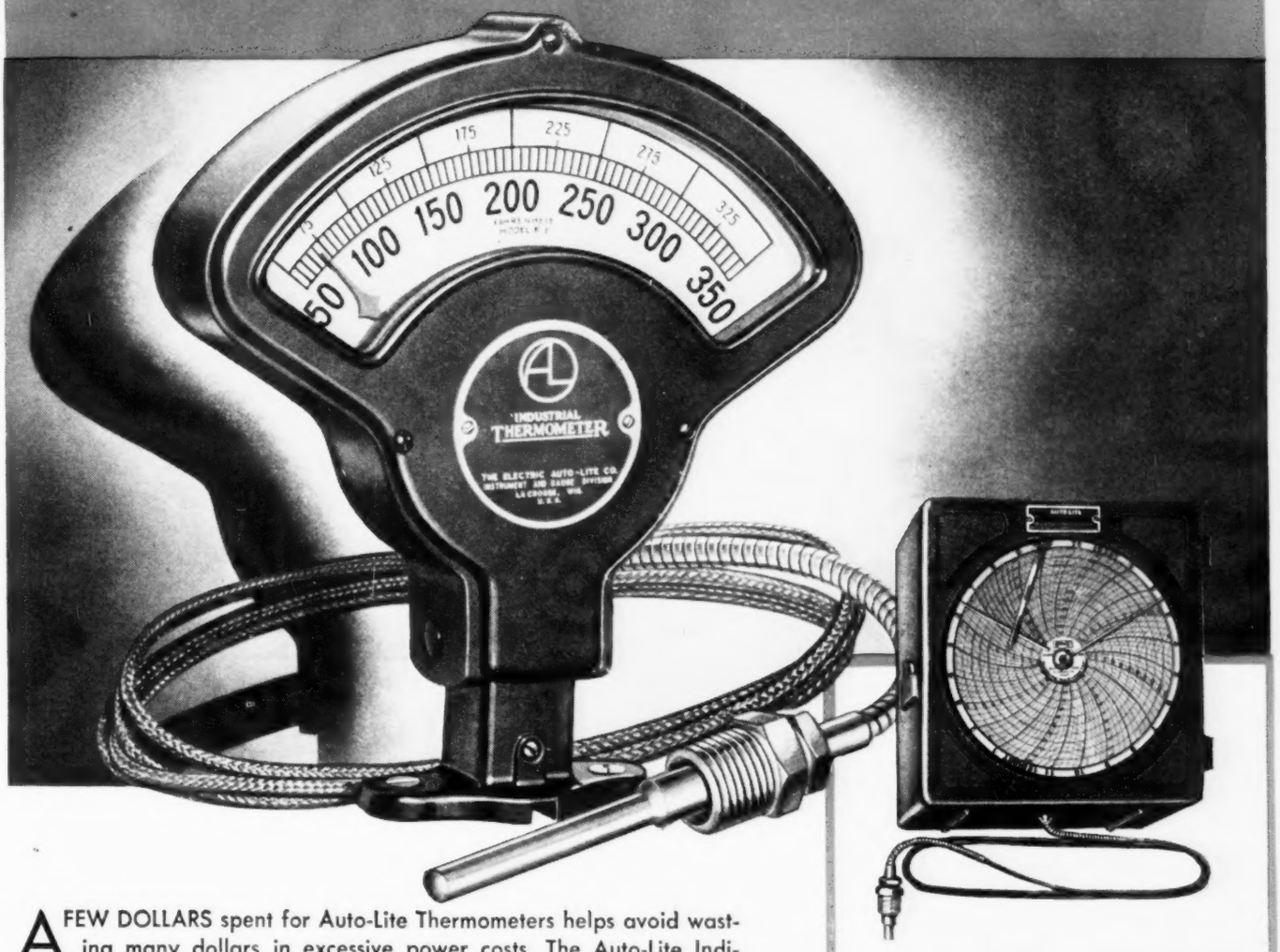
**IRON FIREMAN**

**Automatic Coal Stokers and Oil Burners**

***INDUSTRIAL • COMMERCIAL • RESIDENTIAL***

AUTO-LITE BRINGS YOU

# ACCURATE TEMPERATURE INDICATING AND RECORDING




A FEW DOLLARS spent for Auto-Lite Thermometers helps avoid wasting many dollars in excessive power costs. The Auto-Lite Indicating Thermometer F-1, above, reliably reports temperature performance in processing and storage operations. It aids in maintaining uniform production and avoiding spoilage of materials. Supplied with capillary tubing, this thermometer may be mounted at some distance from the temperature source for convenient and systematic observation.

**THE ELECTRIC AUTO-LITE COMPANY**
INSTRUMENT & GAUGE DIVISION • TOLEDO 1, OHIO
NEW YORK: CHRYSLER BUILDING • CHICAGO: 600 S. MICHIGAN BLVD.

## AUTO-LITE
### RECORDING THERMOMETER

Records temperature for 24-hour or 7-day operation cycles. Here is permanent proof of temperature behavior! 6" chart with range coverage equal to charts of larger diameter. Available with capillary tubing for remote reading.

AUTO-LITE

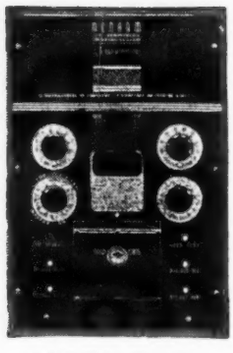
INDICATING & RECORDING
**THERMOMETERS**

TUNE IN AUTO-LITE'S NEW RADIO SHOW "LAWYER TUCKER" — THURSDAYS 9:00 P. M. — E. T. ON CBS

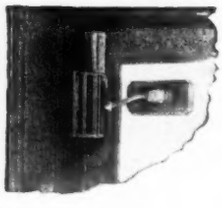
# DUNHAM TEAMWORK
## gives you Accurate Control of Temperatures

Like a baseball pitcher with a good "change of pace," the Dunham System provides variations in pressure, temperature and volume of steam — to maintain comfortable inside temperatures — as rapidly as changing weather conditions may require. This system operates automatically, with the efficiency of a smooth-working team, to assure you of heating that is highly satisfactory, economical and trouble-free: Bulletin 631 with complete details will be sent you upon request. C. A. DUNHAM COMPANY, 450 East Ohio Street, Chicago 11, Ill.

RESISTANCE THERMOMETER



CONTROL PANEL



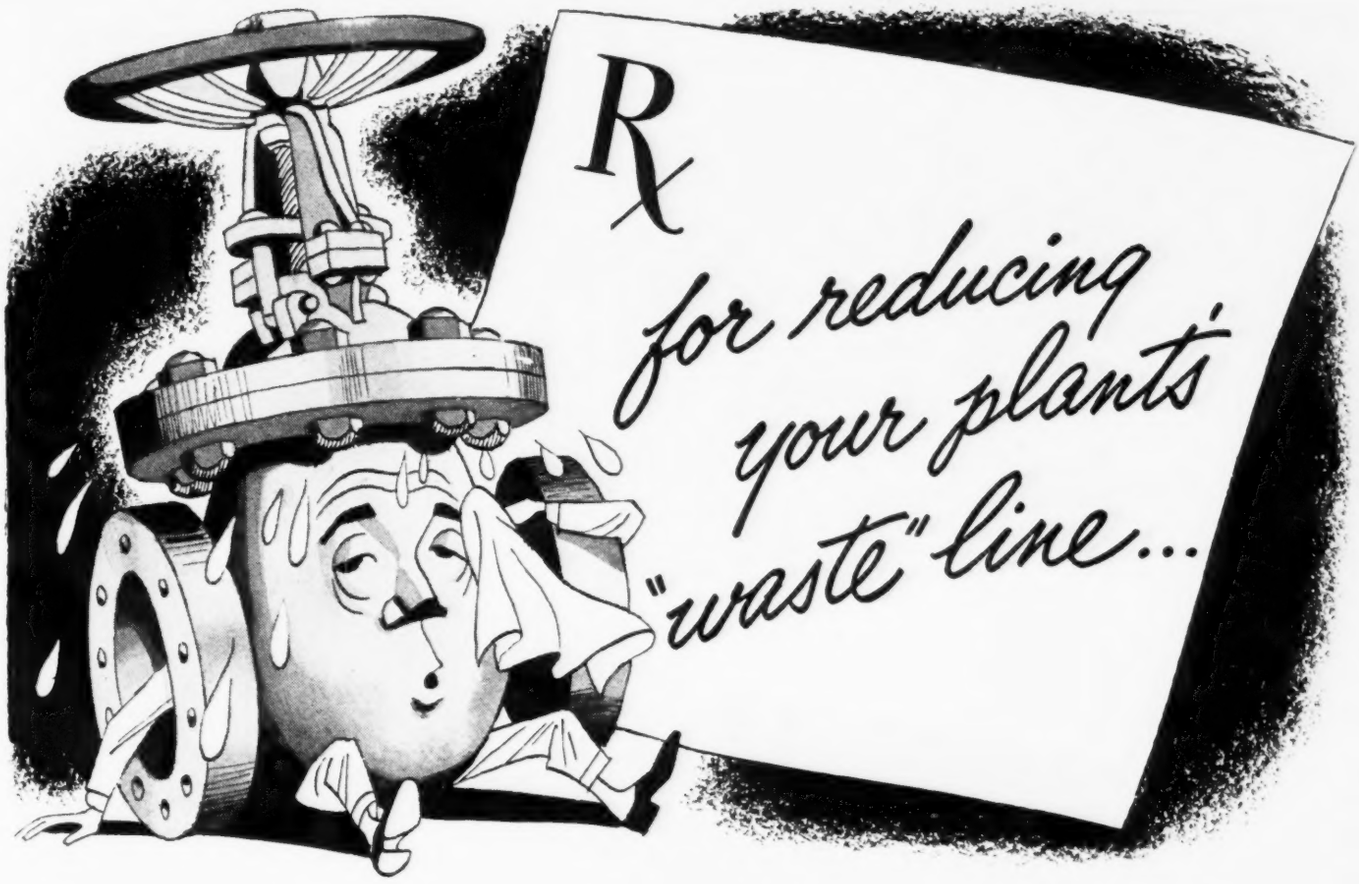
SELECTOR

HEAT BALANCER

CONTROL VALVE

D547 F

# DUNHAM HEATING MEANS BETTER HEATING!




## B-H No. 1 Insulating Cement makes it easy to keep BTU's where you want them

Here's the fast, efficient way to prevent fuel waste through the surface of valves, fittings and other irregular surfaces.

*Fast*—because you simply add water, mix and apply. B-H No. 1 sticks instantly—won't slide off bottom surfaces or roll up behind the trowel.

*Efficient*—because it's compounded of *Black* Rockwool—insulates up to 1800°F. For example, a 3-inch application reduces 800°F. surface temperature to 150°F.

*Other advantages:* B-H No. 1 doesn't crack or peel. A special rust inhibitor safeguards against corrosion, assures a permanent bond. Reclaimable up to 1200°F.

Check over the places where you can prevent heat loss. Then send for full information and a working sample of B-H No. 1 Cement.

**Baldwin-Hill**

*Specialists in Thermal Insulation*

Baldwin-Hill Company, 517 Breunig Ave., Trenton 2, N. J.

Send free sample of B-H No. 1 Cement and data book "Industrial Insulations"

Name..... Position.....

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# JUST WHAT PLANT OWNERS NEED!

**FOR SUMMER VENTILATION**

**FOR WINTER FUEL ECONOMY**

*Penn Unit-Heater Thermostat*

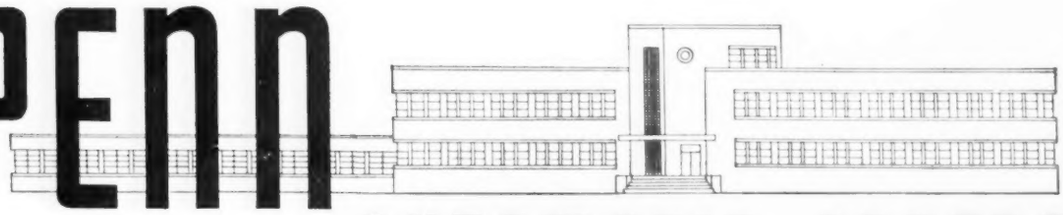
Show plant owners this easy way to provide ventilation in summer . . . fuel economy in winter. They'll appreciate it.

Simply equip unit-heaters with PENN Thermostats. The fans can then be used to provide summer ventilation. The built-in "on-off" feature permits manual control of fan operation whenever desired. By rotating the dial to "on" position, it assures continuous operation of the unit blower.

In winter months this same "on-off" feature will save fuel for plant owners. Merely rotate the dial to the "off" position. This stops heat flow during idle periods—to little-used areas —or to areas where heat can escape, such as shipping or receiving rooms which may be exposed for considerable periods to outside temperature.

For further information on Unit-Heater Thermostats . . . or practical assistance on any heat control problem . . . *write Penn Electric Switch Co., Goshen, Ind.* Export Division: 13 E. 40th St., New York 16, U. S. A. In Canada: Penn Controls, Ltd., Toronto, Ont.

# PENN



## AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, ENGINES, PUMPS AND AIR COMPRESSORS

# Now Advertised to Millions!

Not just heat... but mellow sun-like warmth
Hydro-Flo Radiant Panel Heating
Plus
more hot water than you can use ... all year 'round
Kitchen
Laundry
Hydro-Flo HEAT
FORCED HOT WATER HEATING FOR RADIATOR, CONVECTOR, RADIANT BASEBOARD AND RADIANT PANEL SYSTEMS
BELL & GOSSETT CO.
MORTON GROVE, ILLINOIS

For years the Bell & Gossett Co. has promoted the interests of radiant heat by supplying the industry with comprehensive sales helps and engineering data on forced hot water heating systems.

Now the many advantages of B & G *Hydro-Flo* Heat *are being presented direct to the public!* Month after month, millions of the best home building and modernizing prospects will be reached. Leading home service magazines, with nation-wide circulations, are scheduled to broadcast the story of B&G *Hydro-Flo* Heating Systems.

This drive to open up new markets is of genuine value to you! It's bound to intensify the present widespread interest in forced hot water heat . . . sure to increase your opportunities to sell and make a profit on B & G *Hydro-Flo* Heating Systems.

If you haven't full information, write today. A complete assortment of descriptive literature is available to help you sell and install B & G *Hydro-Flo* Heating equipment.

*Typical B & G advertisements now appearing in Better Homes and Gardens, American Home, House and Garden, House Beautiful and Small Homes Guide.*

**Hydro-Flo* HEAT**

**BELL & GOSSETT COMPANY**

Dept. AA4, Morton Grove, Illinois *REG. U. S. PAT. OFF.

# Pipe All Hands

Official U. S. Navy photograph taken at Philadelphia Navy Yard. Boatswain's mate piping all hands to "chow" over ship's public address system.

*-pipe with the yearmark!*

Did you ever see a pipe sailing? WHEATLAND, the steel pipe with sea legs, services the sailor's home as well as the landlubber's. Tested and prepared for every pipe use and every plumbing satisfaction.

## WHEATLAND TUBE COMPANY

**Bankers Securities Building • Juniper & Walnut Streets • Philadelphia 7, Penna**

For well over half a century the trade name SAL-MO has stood for quality. Today the latest in new equipment combined with methods developed exclusively by SAL-MO, means the finest in Asbestos Products. The popularity of SAL-MO Products has called for a constant increase in production. Today we are in a position to serve you promptly. Send your next order to SAL-MO.

*Your inquiries are invited*

**SALL MOUNTAIN COMPANY**

**ANDOVER 2414 · 176 WEST ADAMS ST. · CHICAGO 3, ILL.**

# 26 standard sizes

## for Economy...

*...Quick Delivery*

# Tri-Flex

## GRILLES *and* REGISTERS

USE Tri-Flex... IN THE 26 STANDARD SIZES*

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| 8 x 4 |
| 10 x 4 |
| 10 x 6 |
| 12 x 4 |
| 12 x 5 |
| 12 x 6 |
| 14 x 4 |
| 14 x 5 |
| 14 x 6 |
| 16 x 5 |
| 16 x 6 |
| 20 x 5 |
| 20 x 6 |
| 20 x 8 |
| 24 x 5 |
| 24 x 6 |
| 24 x 8 |
| 24 x 10 |
| 24 x 12 |
| 30 x 6 |
| 30 x 8 |
| 30 x 10 |
| 30 x 12 |
| 36 x 8 |
| 36 x 10 |
| 36 x 12 |

*for non-standard sizes, write Factory

Size standardization of Tuttle & Bailey TRI-FLEX Grilles and Registers, resulting in more economical production methods, means cost savings to you, speeded-up deliveries. Surveys indicate that air conditioning Engineers, Architects and those responsible for the installation of air conditioning systems agree that the twenty-six sizes listed as standard for TRI-FLEX will meet requirements of the majority of commercial, industrial and institutional applications.

The TRI-FLEX line, made up of various combinations of three flexible units — grille, deflector blades, multi-shutter damper — provides really effective control of air distribution *at the vital point of air delivery.*

For performance, attractive appearance, economy, availability . . . be sure to recommend and install TRI-FLEX for your next air conditioning job. Your customer will appreciate the choice. WRITE TODAY for a copy of Bulletin No. 47TF . . . full description of all TRI-FLEX units, detailed engineering data, list prices, complete information for specifying and installing.

TUTTLE & BAILEY

NEW BRITAIN, CONNECTICUT

The best "advertising" for functional-minded architects, engineers and contractors is the excellence of their own craftsmanship . . . represented by modern structures that make living and working more pleasant. That is why they invariably regard an air-conditioning installation with Anemostat draftless air-diffusion as a job well done. A job that *advertises* them. A job to be proud of!

Anemostat takes the "raw materials" of air-conditioning and actually "processes" them into COMFORT. There are no draft-producing grilles or registers, for Anemostat air-diffusers distribute the conditioned air in pre-determined, controlled patterns. Result: there are no drafts . . . no dead air pockets . . . *room temperature and humidity are equalized throughout.*

Because Anemostat wall or ceiling diffusers permit employment of stepped-up duct velocities and greater temperature differentials, duct sizes and duct outlets may be reduced — an important economy feature. Because Anemostats have no moving parts to wear out, maintenance cost is nil.

Thousands of Anemostat installations throughout the country — in virtually every industry — are putting new comfort into air-conditioning. So, remember to specify Anemostat draftless air-diffusion for an air-conditioning job you'll be proud of!

**HOW ANEMOSTATS *COMPLETE* AIR-CONDITIONING**

The patented Anemostat distributes air — of any duct velocity — in all directions and in a multiplicity of planes. Simultaneously, counter-currents created by the device siphon *into the Anemostat* room-air equal to about 35 per cent of the volume of the supply air. This room-air is mixed with the supply-air *within the diffuser* before the air-mixture is discharged into the room. Furthermore, velocity of the incoming air is instantly reduced within the Anemostat by air-expansion.

In this way, the Anemostat noiselessly diffuses air of any duct velocity throughout the entire room . . . eliminates drafts . . . closely equalizes temperature and humidity . . . prevents air-stratification. There is no substitute for Anemostat air-diffusion!

Write for information.

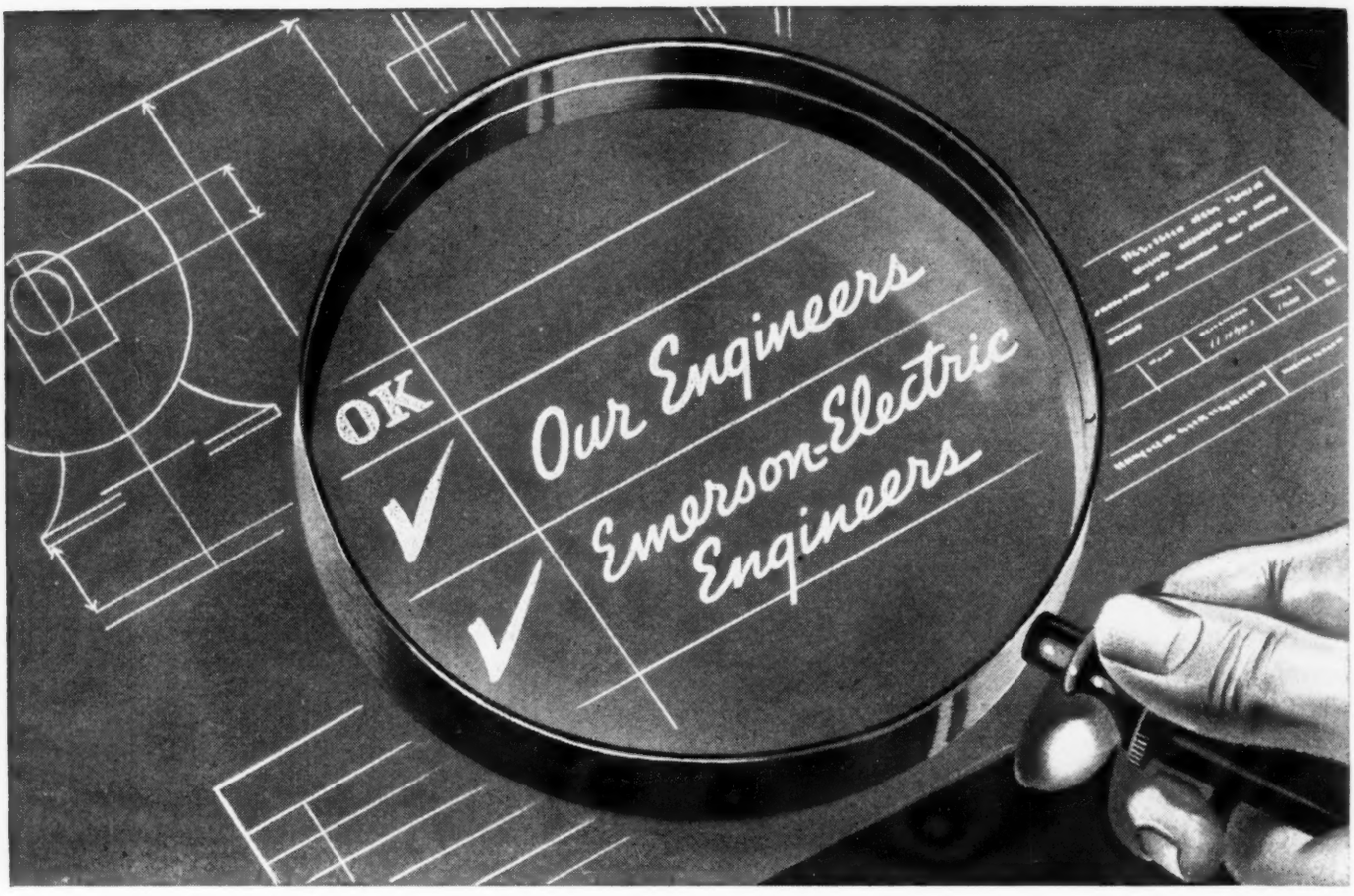
**ANEMOSTAT**

REG. U. S. PAT. OFF.

**ANEMOSTAT CORPORATION OF AMERICA**
**10 East 39th Street, New York 16, N. Y.**
*REPRESENTATIVES IN PRINCIPAL CITIES*

"NO AIR-CONDITIONING SYSTEM IS BETTER THAN ITS AIR DISTRIBUTION"

AC-1137

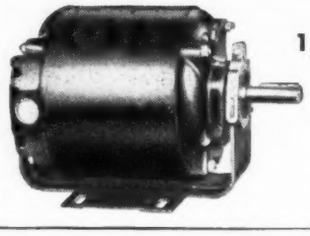



# DOUBLE-CHECK your New Product Blueprints with *TWIN-GINEERING!*

WHEN the Okeh of Emerson-Electric Motor Engineers is chalked up beside your own, your new product designs are *double-checked.*

Such collaboration—*Twin-gineering,* we call it—may help you eliminate much costly engineering backtracking, may uncover manufacturing short cuts, may help you put your product on the market with competitive advantages necessary for market success.

For the present, Emerson-Electric is booked solid on motor orders. But, Emerson-Electric Engineers, backed by 56 years' experience, have never been longer on ideas and skill; and never more ready to share these advantages in suggesting money-saving motor applications for your improved or new appliances and equipment. Your inquiry is invited.



**1/20 to 5 Horsepower AC and DC**

For 56 years, Emerson-Electric has specialized in the development and manufacture of electric motors, 5 Horsepower and smaller.

**THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.**

*Branches:* New York • Chicago • Detroit • Los Angeles • Cincinnati • Davenport

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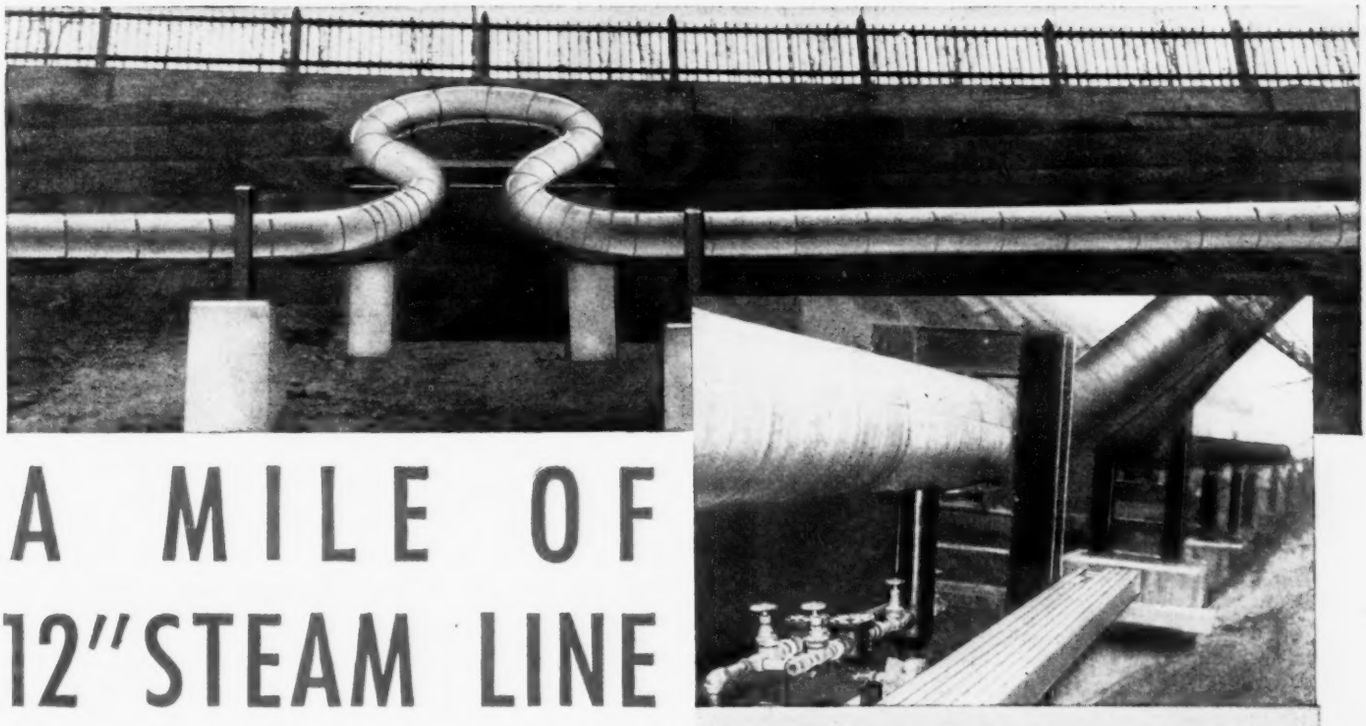
**EMERSON ELECTRIC**

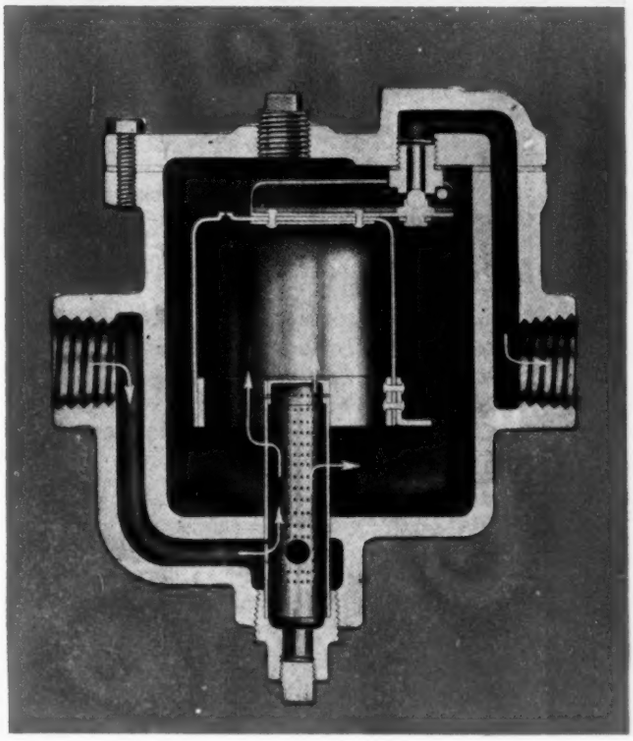
MOTORS · FANS — APPLIANCES



# A MILE OF 12" STEAM LINE

## ...*drained* WITH SARCO BUCKET TRAPS

At each bend on this mile long outdoor steam line, duplicate Sarco Inverted Bucket Traps are used to remove the condensation. This installation emphasizes the capacity and reliability of this popular trap which is used extensively on all types of steam using equipment.



### ADVANTAGES

1. Straight-through connections
2. Built-in strainer
3. All mechanism attached to easily removable cover
4. Can be equipped with thermostatic air by-pass

### USES

| | | |
|---|---|---|
| DRYERS | PROCESS TANKS | UNIT HEATERS |
| KETTLES | SEPARATORS | VULCANIZERS |
| PRESSES | STEAM LINES | PUMPS |

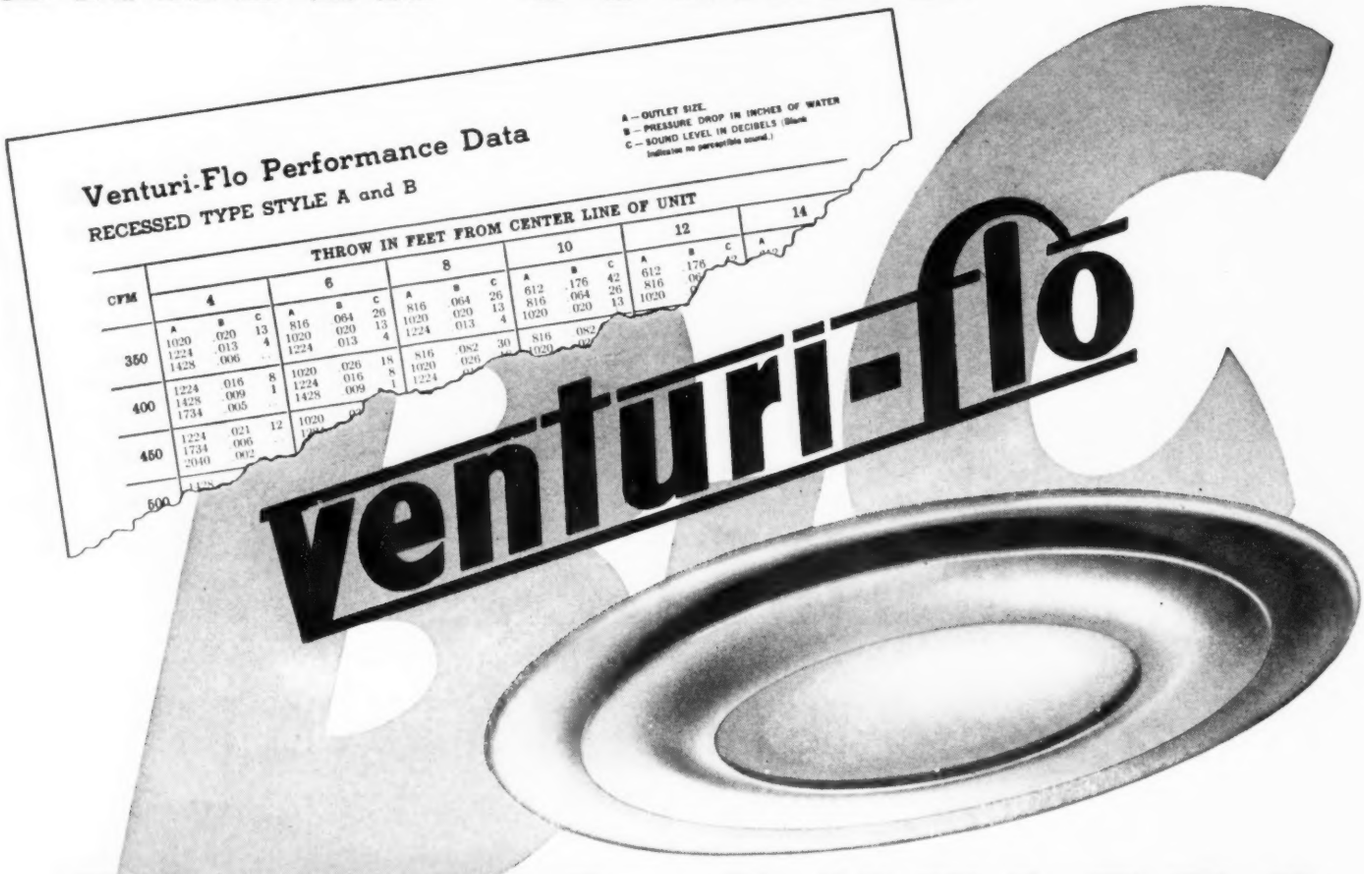
Standard sizes, ½" to 2" to 250 lbs.; forged steel types to 900 lbs. Catalog No. 350.

144

**SARCO** SAVES STEAM

**SARCO COMPANY, INC.**
*Represented in Principal Cities*
**475 FIFTH AVE., NEW YORK 17, N. Y.**
SARCO CANADA, LTD., TORONTO 1, ONTARIO

# BARBER-COLMAN




# CEILING OUTLETS

## "PICKED FOR PERFORMANCE" FROM DEPENDABLE DATA

Using the exceptionally complete Performance Data Sheets developed by Barber-Colman laboratories, you can accurately select the correct VENTURI-FLO Ceiling Outlet for any installation. In fact, for every combination of volume and throw, *three choices* are listed, differing in size, pressure drop, and sound level. With this range of choices, it is easy to pick for size continuity, system capacity, or occupancy conditions — and be *sure* of getting proper performance. Use Barber-Colman VENTURI-FLO for Guaranteed Air Distribution.

## AVAILABLE FOR PROMPT DELIVERY

Manufacturing facilities at Barber-Colman are set up to handle VENTURI-FLO orders efficiently, eliminating delays and making it possible for contractors to schedule deliveries with assurance. *Write today for complete information.*

## *Features*

Quiet operation.

Rigid construction.

High diffusion efficiency.

Wide range of sizes.

Available in several types, including combined supply and exhaust units.

Can be combined with lighting fixtures.

## BARBER-COLMAN COMPANY

1224 ROCK STREET • ROCKFORD, ILLINOIS

**AMERICAN THERMAL INDUSTRIES**

**AIR CONDITIONING PACKAGE UNITS**

Ameri-therm

READY FOR

# Immediate Delivery!

**AVAILABLE FOR IMMEDIATE SHIPMENT!**

3 ton, 5 ton and 7½ ton Ameri-therm Units are in stock at all times.

Ameri-therm Air-conditioners are built to tested specifications. Available in 3 to 15 horsepower units.
*(Can be furnished with heating coils)*

## Ameri-therm GIVES YOU ALL THESE EXCLUSIVE FEATURES

★ *Balanced System In One Package!*
Every component element in this outstanding Ameri-therm Package Unit is time tested and perfectly balanced. Your customer is always assured the most effective cooling at a negligible cost.

★ *Streamlined Styling!*
Nearly every type store interior will be enhanced by a handsome, modern, streamlined Ameri-therm Air-conditioning Unit.

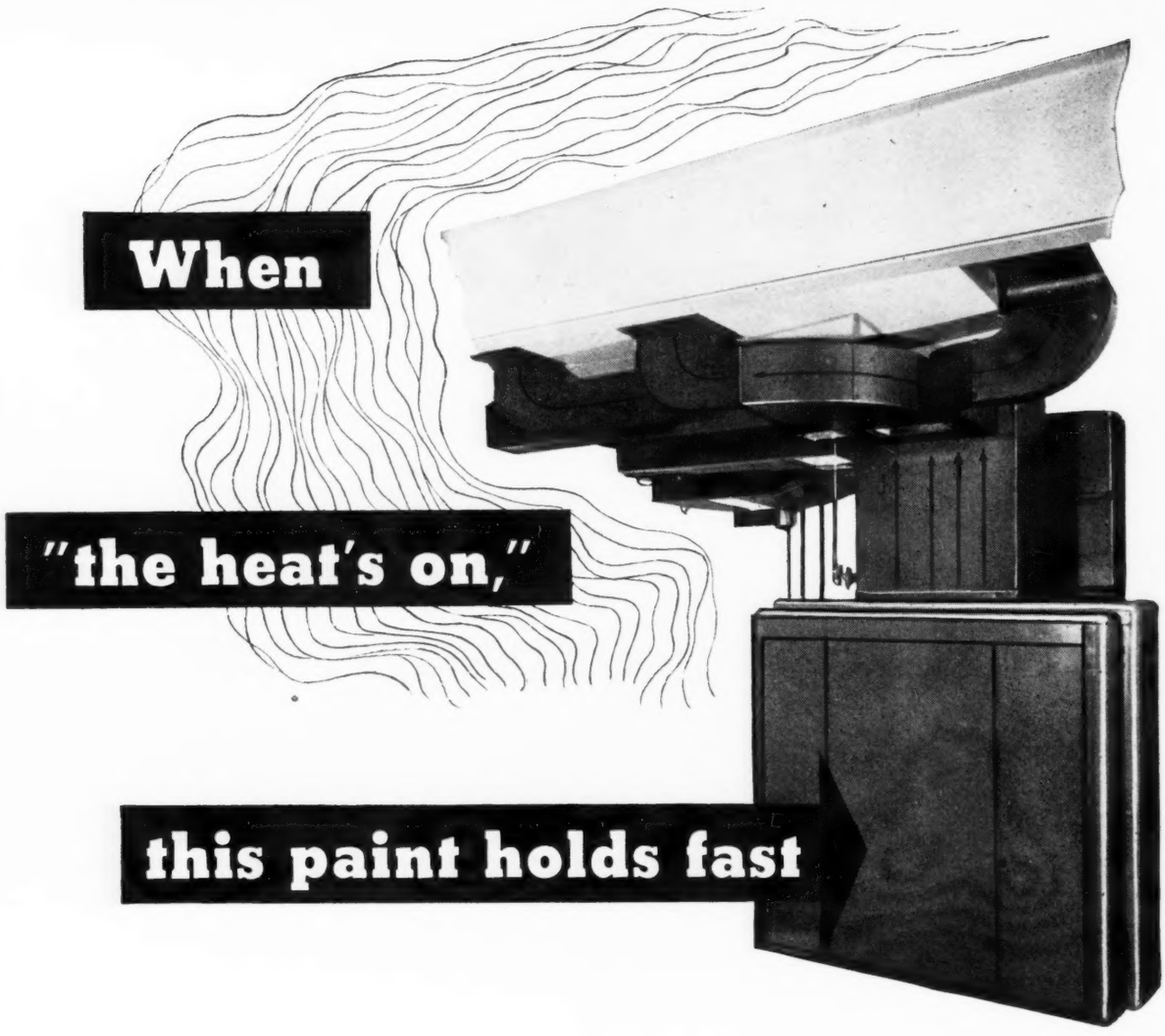
★ *Automatic Controls!*
Non-technical personnel in offices, stores, restaurants or places of entertainment can easily regulate temperature conditions with the Ameri-therm Unit. **Only two** easy-to-operate dials completely and effectively control Ameri-therm Air-conditioning Package Units. **Controlled Air-conditioning** means constant controlled temperature.

★ *Multi-Unit Installations!*
Ameri-therm Units offer extreme flexibility of installation. Nearly all field requirements—single or multiple installations—can be handled easily . . . Ameri-therm Units are flexible because of the advanced design incorporated in service connections. Remote installations, too, are possible with little effort and expense.

ENGINEERED AND MANUFACTURED *by*

## AMERICAN THERMAL INDUSTRIES, INC.

**440 Illinois Avenue, Detroit 1, Michigan**




• The painted surfaces of furnace casings, hot-air ducts and other heating and ventilating equipment have to be able "to take it." That's why more and more contractors are turning to Galvanized ARMCO Ingot Iron with the original PAINTGRIP finish.

• Galvanized ARMCO Ingot Iron has long been the choice of exacting sheet metal men because it's uniformly ductile and forms fast and accurately. When this versatile metal is given the mill-Bonderized PAINTGRIP finish at the mill, it is ready to take and hold paint. The neutral PAINTGRIP film assures complete insulation of the paint from the raw zinc—keeps it from drying out, flaking or peeling off before its time.

• Remember, too, that it actually costs less to use ARMCO Galvanized PAINTGRIP sheets than to use ordinary galvanized steel and acid-treat before painting.

• Today Armco mills are rolling 'round the clock trying to catch up with your demands. So tell your sheet-metal contractor to keep in touch with his Armco distributor. The American Rolling Mill Company, 371 Curtis Street, Middletown, Ohio. Export: The Armco International Corporation.

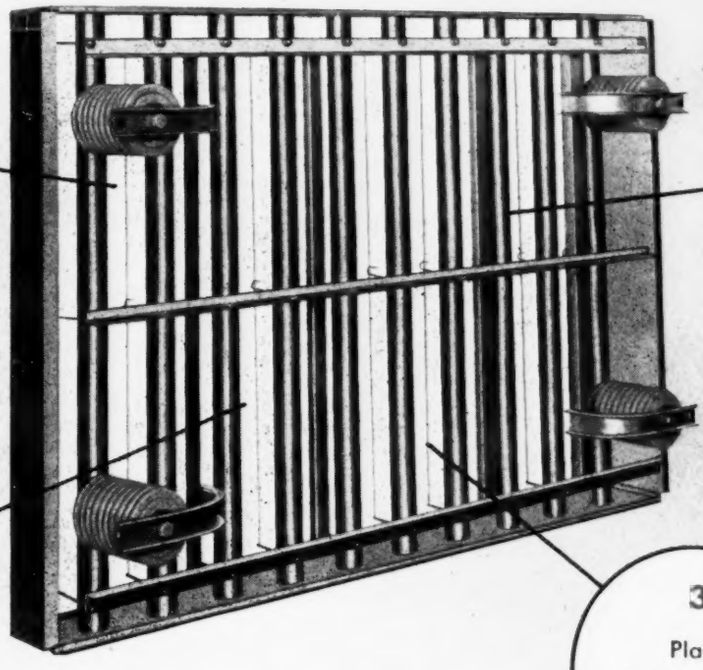
GALVANIZED PAINTGRIP ★ ARMCO ★ INGOT IRON

**THE AMERICAN ROLLING MILL COMPANY**

• SPECIAL-PURPOSE SHEET STEELS • STAINLESS STEEL SHEETS, STRIP, BARS AND WIRE

HOW TO BUILD AN *Electronic Precipitator* ...No. 3

# *Ionizer Design notes...*




The most important single element in electronic precipitation equipment is the ionizer section. Designed to ionize airborne dust, smoke, soot, pollens, bacteria, it must work right, stay on the job, be easy to fix.

Hence these RAYTHEON rules:

Utilize aircraft structural techniques to combine strength and rigidity with light weight. Avoid possibility of major disruption by providing a *separate ionizer* for each collector cell. Arrange for each ionizer to slide into framework independently of collector. Keep ionizer wires *short* and thus less likely to break, more easy to restring.

Bulletin DL-P-503 gives detailed information. How many copies would you like?

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*Excellence in Electronics*

**RAYTHEON MANUFACTURING COMPANY**

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Builders of Raytherm Dielectric Heaters for every industrial application.
Synchronous Controls for Resistance Welding and other
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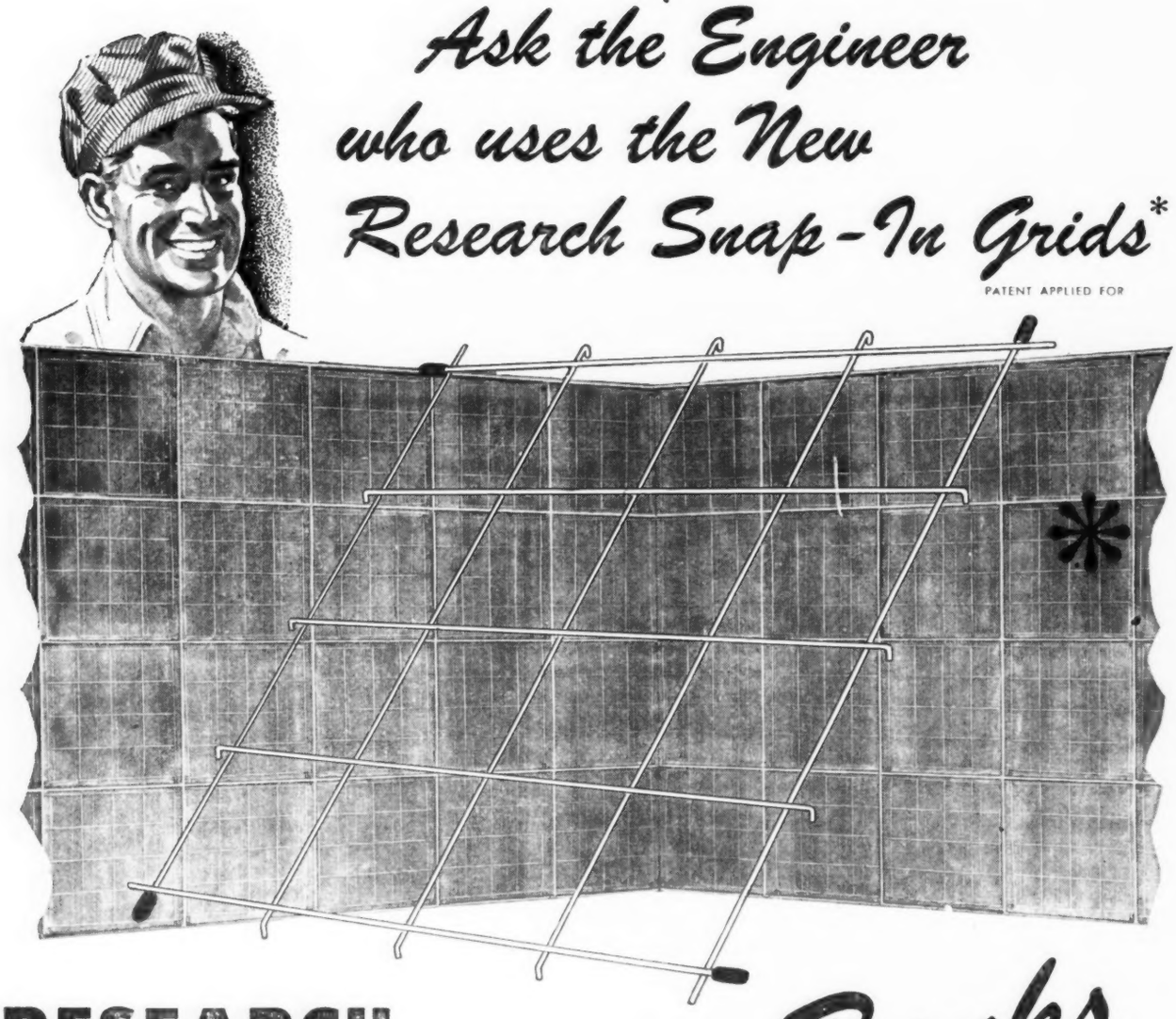
# *Ask the Engineer who uses the New Research Snap-In Grids**

PATENT APPLIED FOR



# RESEARCH *Filter Banks*

*Free*

Descriptive folders and technical data sheets supplied upon request.

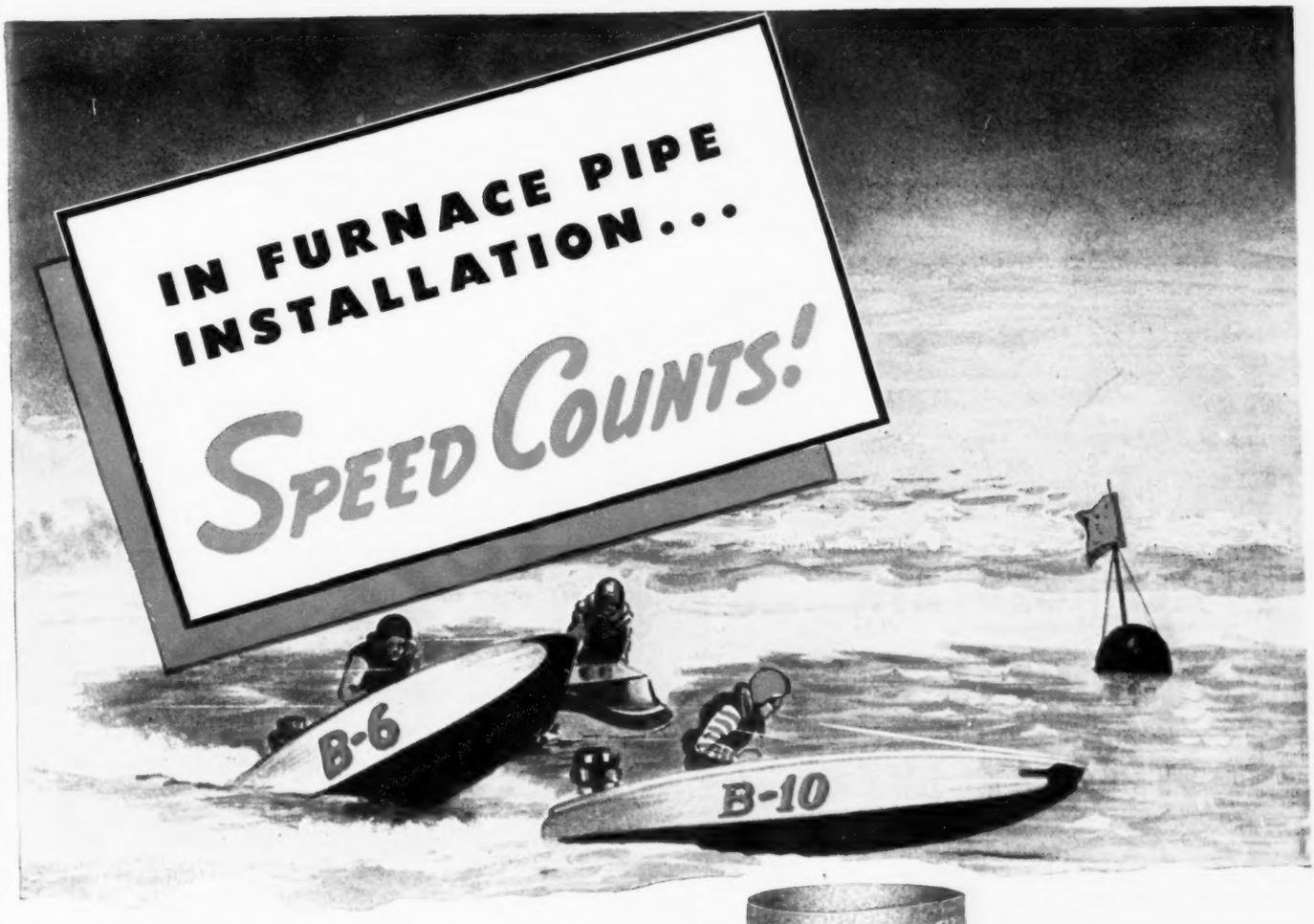
## *are Easier to Service — Give Better Air Filtration, Save Money, Tempers, Labor Cost*

The new Research Snap-In Grids* are used to hold filters securely in filter banks. The simple, quick and easy servicing will save your customers many costly labor hours and provides a selling story that can't be matched by any other air filter. Grids may be used over and over . . . only filter pads need changing. No fuss, no hooks, no bother!

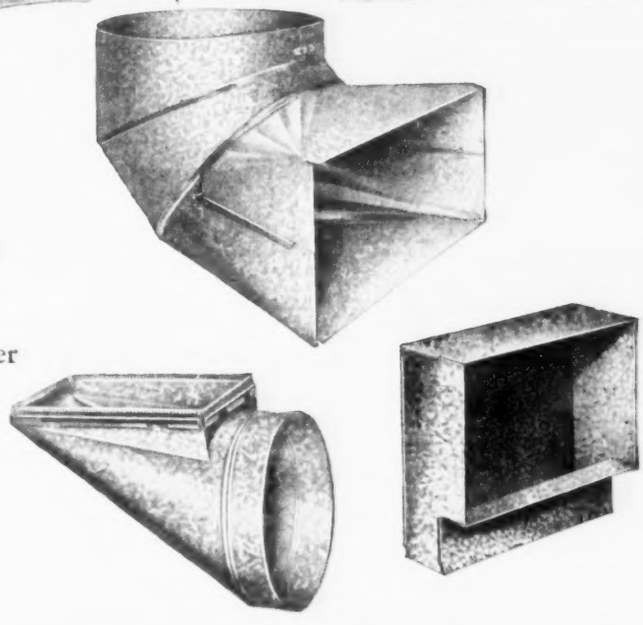
** Another Exclusive Research Feature*

**RESEARCH PRODUCTS CORPORATION**

MADISON 3, WISCONSIN




Labor costs go down and profits go up when you use C&L Lamneck furnace pipe and fittings! Each part is precision engineered for accurate fit. No time is wasted in cutting and trimming—fittings go into place smoothly and quickly. For easier, faster installations at greater profit, specify C&L Lamneck dependable furnace pipe and fittings. Write for catalog and name of the C&L jobber nearest you.



ALWAYS *Specify*

C&L *Lamneck* TRADE MARK

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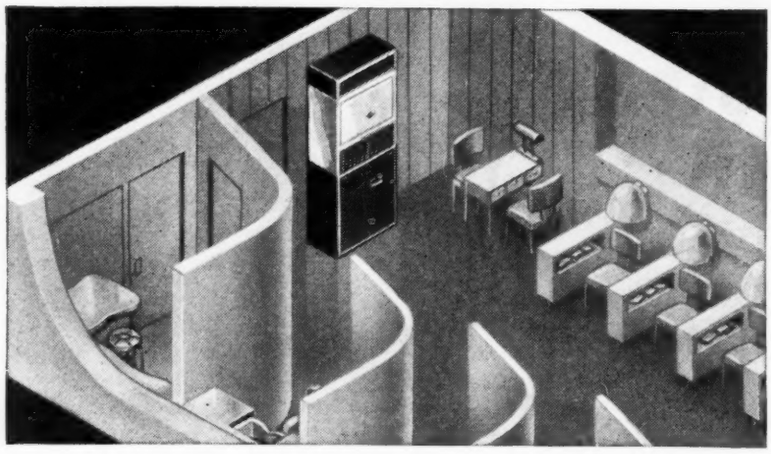
*Other C&L Products:* C&L Blow Torches, Fire Pots; C&L Hoffman Water Heaters; Monarch Builders Finish Hardware; Buckeye Corn Cribs, Grain Bins; Silver Shield Silos.

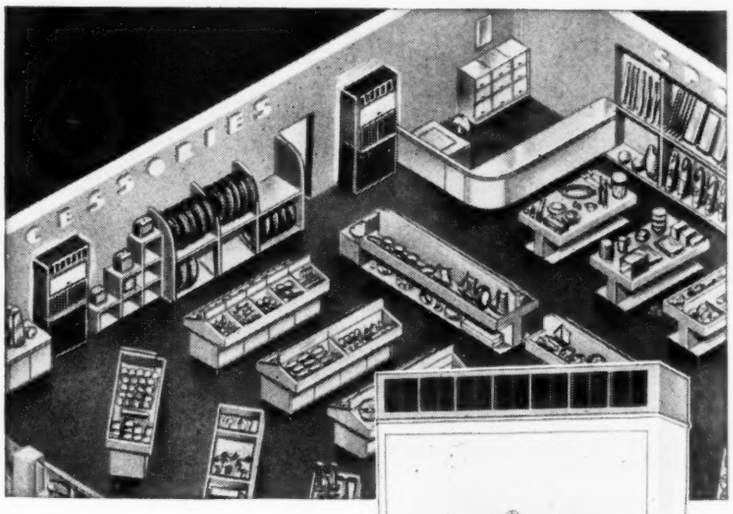
**FURNACE PIPE AND FITTINGS**

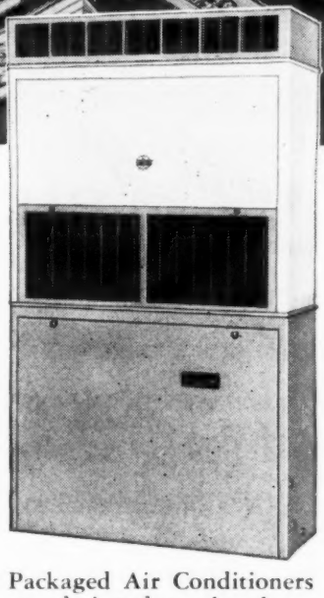
★ SIMPLIFIED COOLING BY CHRYSLER AIRTEMP ★



## ← Single or Multiple Installations

# PACKAGED AIR CONDITIONERS MEET PRACTICALLY EVERY AIR CONDITIONING REQUIREMENT!





Packaged Air Conditioners are designed so that heating coils can be placed in the cooling units for year-round air conditioning.

IT'S easy—*and economical*—to air condition almost any place with the popular Packaged Air Conditioners, pioneered by Chrysler Airtemp. It doesn't matter if you are air conditioning a small shop or large store; an office or an office building; a hotel room or an entire hotel—Packaged Air Conditioners will do the job.

They can be installed singly or in multiple—according to the air conditioning need. Because of compact design, they take up as little as 4.7 square feet of floor space. They can be moved easily. Operating and maintenance costs are amazingly low. The exclusive Radial Sealed Compressor in the Packaged Air Conditioner was developed in the famous engineering laboratories of Chrysler Corporation. Pressure lubricated, the vital moving parts are Superfinished, a Chrysler process that gives longer life and greater efficiency.

For ten years Chrysler Airtemp has led the Packaged Air Conditioner field. More of these units have been installed than any other make. They are thoroughly dependable and furnish a simple solution to most air conditioning requirements.

**AIRTEMP DIVISION OF CHRYSLER CORPORATION, DAYTON 1, OHIO**

In Canada—Therm-O-Rite Products, Ltd., Toronto

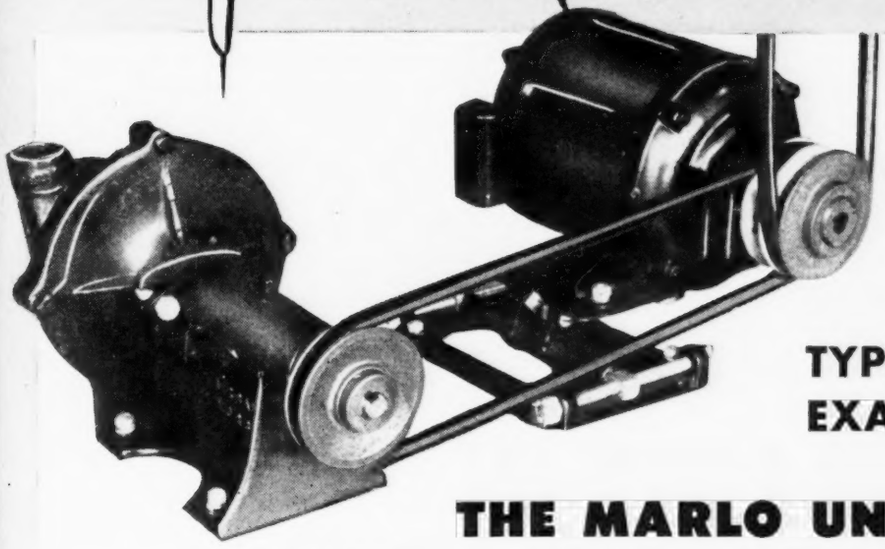
*Automatically Yours*

CHRYSLER AIRTEMP
DIVISION OF CHRYSLER CORPORATION

**PACKAGED AIR CONDITIONERS**

**HEATING • AIR CONDITIONING • COMMERCIAL REFRIGERATION**

Marlo MEANS SOUND ENGINEERING ...in every detail



TYPICAL EXAMPLE:

## THE MARLO UNIDRIVE

A single motor powers *both Fan and Pump* on all Marlo Spray-Type Industrial Coolers, Evaporative Coolers, Condensers and Cooling Towers. This simplified drive:

- Assures uniform belt tension — automatic take-up
- Eliminates special extended-shaft motors and pumps; simplifies electrical wiring
- Increases efficiency — reduces operating costs
- Standard units permit easy field replacement

You get more for your money from

**MARLO**

**HEAT TRANSFER EQUIPMENT**

Ball-Bonded Blast Coils — Cooling and Heating • Air Conditioning and Refrigeration Apparatus • Industrial Blower Units • Unit Coolers • Evaporative Condensers and Coolers • Low-Temperature Apparatus • Cooling Towers
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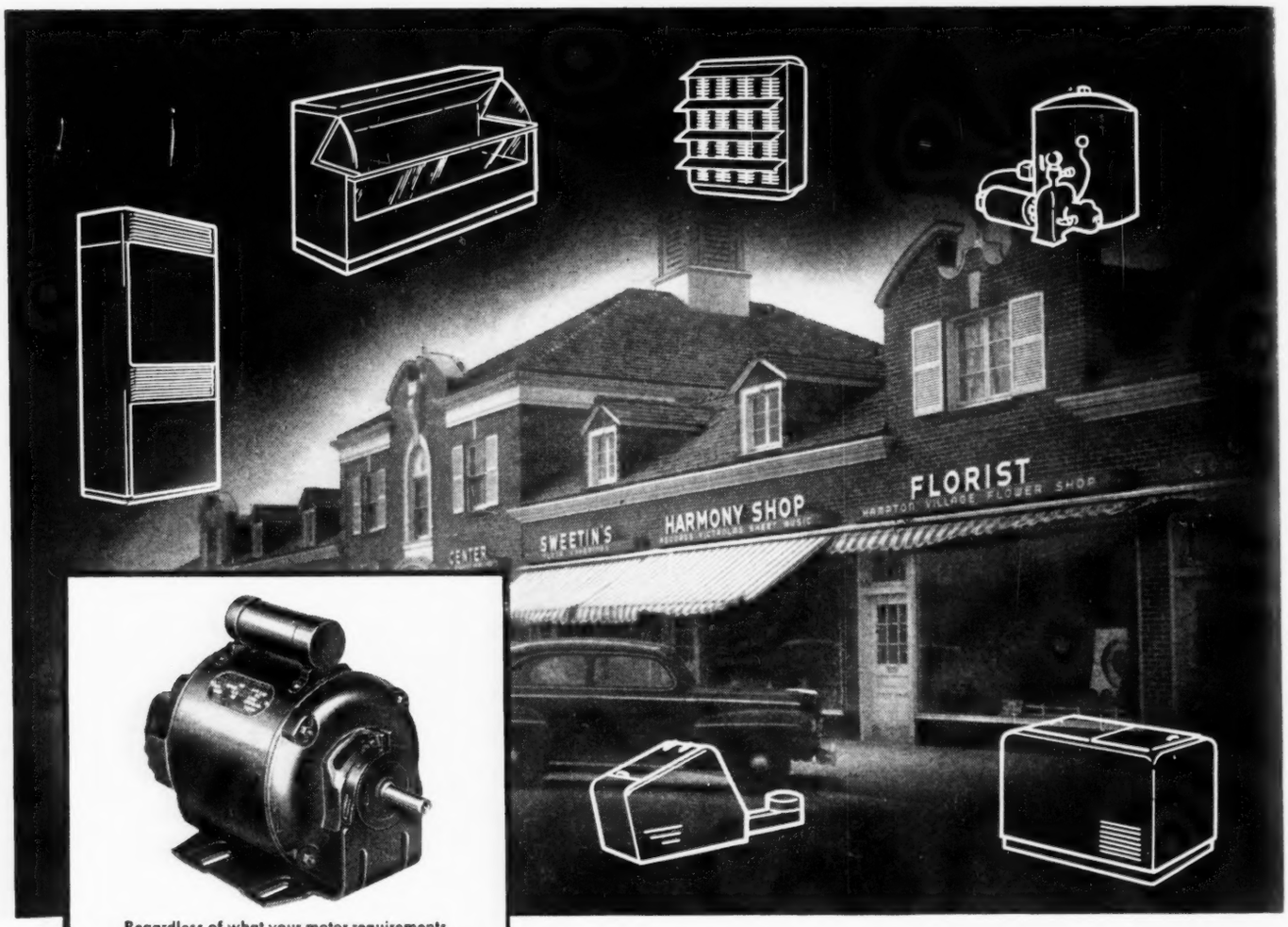
MARLO = HEAT TRANSFER
Since 1925

**MARLO COIL CO. • ST. LOUIS 10, MO.**






Regardless of what your motor requirements may be—small motors . . . large motors . . . Wagner makes them all. The motor illustrated is typical of the Wagner line of single-phase and polyphase motors.

# "Your MOST OBEDIENT SERVANT"

## . . . the Wagner Fractional Horsepower Motor

Small in size . . . low in price . . . but it does a thousand different jobs in the stores, the shops, homes, schools and farms of America. Wagner fractional horsepower motors furnish the power to operate quick freeze units, compressors, stokers, pumps, and many other motor-driven appliances.

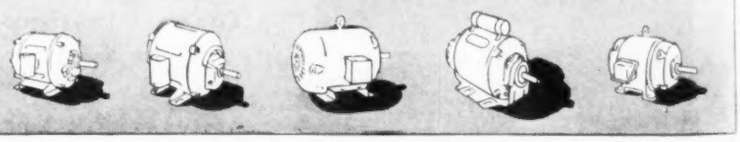
The unfailing dependability of Wagner Fractional Horsepower Motors has made them the first choice of many manufacturers of small machines and appliances. Millions of these motors have been bui't in the huge Wagner plant, and while they still play "hard to get" they are coming from Wagner's motor assembly lines in ever-increasing quantities to help meet the pent-up demand for these outstanding small motors.

Whether your motor requirement is large or small, Wagner can furnish a motor correctly designed to give you greater continuity of operation. The complete line of Wagner motors covers a wide range of types and sizes for every application. More than half a century of motor building experience assures the reliability of every motor bearing the Wagner name. Users of Wagner motors also profit by our quick, convenient, nationwide service facilities.

Twenty-nine branch offices, located in principal cities, are ready to assist you, without obligation, whenever you have a motor problem. Write for Bulletin MU-185 for information on the complete line of Wagner Quality Motors. Address Wagner Electric Corporation, 6463 Plymouth Avenue, St. Louis 14, Mo.

*Consult Wagner Engineers on all Electric Motor Problems*

Wagner Electric Corporation
EST. 1891



M47-20

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# No other control system offers all these outstanding advantages...

- SELF-OPERATED, NO OUTSIDE CURRENT REQUIRED
- SIMPLIFIED TWO-WIRE CONTROL
- ACCURATE ROOM TEMPERATURE CONTROL
- INTEGRAL SAFETY CONTROL
- SILENT OPERATION

## AUTOMATIC, SAFE, SILENT AND SELF-OPERATED

A completely self-contained and self-operating control system. For natural, manufactured or L. P. gases. For all kinds of domestic, commercial or industrial applications. System consists of the B-60 pilot operated diaphragm type gas valve, the T-80 Series Trimtherm Thermostat, which is scientifically correct in design, and the ingenious pilot generator which produces the operating current, safety control, and main burner ignition. The B-60 Series of controls has set new standards throughout the gas industry. • For complete specifications on the *GENERAL CONTROLS* line of *Automatic, Pressure, Temperature and Flow Controls*, see the new 1946 Catalog 52C. • For Gas Heating Controls, request Service and Instruction Manuals.

**GENERAL CONTROLS**

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*Manufacturers of Automatic, Pressure, Temperature & Flow Controls*

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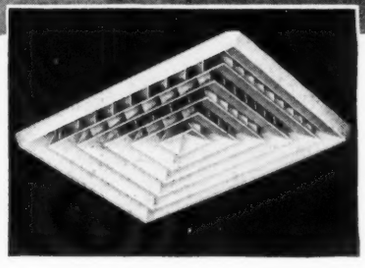
# A DEMONSTRATION CENTER FOR ADVANCED BUILDING TECHNIQUES AND PRODUCTS

*Naturally*

## IT'S AGITAIR TYPE R with *Diffusion Pattern Control*



Modern as tomorrow — from the first floor showroom with its glass door entrances to the model penthouse atop its eight floors. That's the New Weldwood Building.

And in this building which U.S. Plywood uses as a center to demonstrate advanced building techniques and products, you'll find Agitair Type R Diffusers providing correct air distribution.

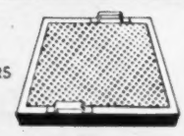
Why Agitair Type R? Because only Agitair Type R blends with the spirit of this new architecture. Because only Agitair Type R gives Diffusion Pattern Control. That means 100% control over air distribution—with no drafts, no blank corners, no hot spots, no cold spots.

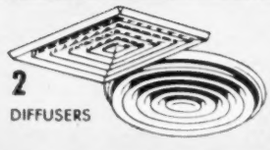
Patented construction permits Agitair Type R to be assembled into numerous patterns which divide the air and discharge it noiselessly in one, two, three or four directions in proportion to the area served.

Result: *100% air distribution in any shape room —from any location.*

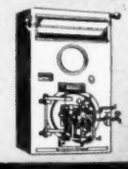
***Write Today for Complete Data***

**KEY POINTS IN AIR CONDITIONING—AGITAIR SERVES BEST**



*and also*
DIRECT-FIRED HOT GAS GENERATING FURNACES *etc.*



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Guest Rooms: *Heating and cooling*

Dining Room and Lobby: *Air conditioning control*

Kitchen: *Process steam and ventilation control*

Boiler Room: *Combustion controls and recording instruments*

**MORE COMFORT....**
**LOWER OPERATING COSTS!**

# *Automatic Controls*

## FOR EVERY HOTEL APPLICATION

EVERY hotel has a broad range of applications for Honeywell's automatic controls. Direct benefits come from lowered heating cost, more efficient operation of air conditioning and steam equipment, and greater comfort for guests. Those responsible for selection and installation benefit by having all controls from one manufacturer, assuring dependable and coordinated operation.

In guest rooms, for example, Honeywell Personalized Heat Control, with a thermostat in each room, enables every guest to select just the temperature he wishes. This system includes a device which minimizes heat loss by shutting off the radiator when the window is open.

Another Honeywell control system—the Weatherstat system—controls the heat supply in accordance with outside temperature, wind and sun effect, and can be "zoned" to equalize heat distribution throughout all parts of the building regardless of varying exposures to wind and sun.

For the kitchen, boiler room, air conditioning and cold storage facilities, there are other Honeywell controls with advantages demonstrated on a dollar-and-cents basis. Remember, only Minneapolis-Honeywell offers a complete line of automatic controls, both electric and pneumatic, for every hotel application. Get the whole story without delay. Just mail the coupon.

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CONTROL SYSTEMS

**MINNEAPOLIS-HONEYWELL REGULATOR COMPANY**
**2603 Fourth Avenue South, Minneapolis 8, Minnesota**

*Please send my free copy of "Automatic Controls for the Modern Hotel"*

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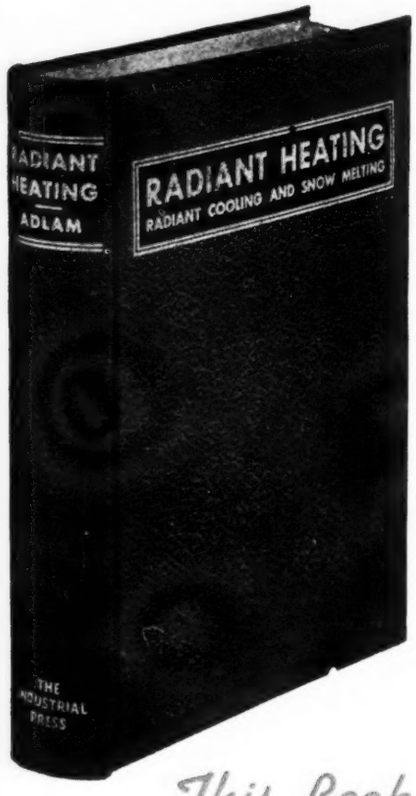
# RADIANT HEATI




This is a thoroughly practical comprehensive treatise giving the essential facts about radiant or panel heating — the basic principles, the working data for the designer and specific instructions on installation. It is based upon both American and European practice.

## *This Book is for —*

**Engineers** who want only those facts and figures which are based upon wide experience and can be applied directly in designing and installing radiant heating systems.

**Engineers or contractors** who want information on this important subject, even though they may never design a radiant heating system.

**Architects** who require sufficient information to advise home and other builders and answer intelligently questions about radiant heating which are bound to arise.

**Everyone** who is interested in a simplified presentation of this efficient method of insuring bodily comfort whether in the home, office, or in public buildings of any kind.

**Building owners,** plant engineers, airport officials, home owners, architects and all engineers who would like to know how walks and driveways may be kept clear of snow by utilizing heating coils for snow melting.

## *Why Mr. Adlam's Book is an Outstanding Treatise*

1—It records the proven results of over thirty years' experience in the design and installation of all types of radiant or panel heating systems.

2—It contains the general information, design formulas and working data which must be used in designing effective systems—the facts which are definitely known to be important.

3—All formulas have been reduced to the simplest terms consistent with sufficient accuracy to meet practical requirements, and simple easy-to-use charts give most of the essential design data without calculation. With these charts you are never lost in a confusing maze of lines.

4—The exact step-by-step procedure in designing and installing radiant heating systems is summarized and you are told just where in the book to find all of the required ready-to-use working data.

5—This treatise contains a section on utilizing radiant heat for snow melting — an original and valuable addition relating to an application now being used effectively and having great future possibilities.

6—A section on radiant cooling deals with summer applications of radiant energy.

7—A total of 120 drawings, 130 working charts, and 59 photographs illustrates the various descriptions and shows clearly the arrangement of numerous installations and types of auxiliary radiant heating equipment.

8—Mr. Adlam, the author, is an outstanding authority on this subject. His thirty years of experience, both here and abroad, have demonstrated the need for the practical information and data presented so clearly in this book.

9—All essential facts may be found easily and quickly and applied directly either to radiant heating, radiant cooling or to snow melting problems.

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# NG

**By T. NAPIER ADLAM**

Snow melting and radiant cooling are special additional features. This book is a dependable manual for the engineer, contractor or architect who needs authoritative information on these different applications of radiant energy.

## A Word about the Author

MR. ADLAM is recognized both in the United States and abroad as an outstanding authority on radiant heating. He was associated with Mr. A. H. Barker when the latter obtained the first patents on radiant heating. Mr. Adlam has had over thirty years' experience with radiant heating in all of its present known phases, including 16 years in the United States.

Mr. Adlam is a member of the American Society of Heating and Ventilating Engineers, the Institution of Heating and Ventilating Engineers, England, the British Institution of Patentees, the exclusive Whitworth Society of Scholars, and is a Fellow of the Royal Society of Arts. During recent years Mr. Adlam has done a lot of pioneer work in connection with radiant cooling and with snow melting by means of embedded pipes, and has developed special automatic controls for these comparatively new fields of research.

He is at present vice-president and general manager of Sarco Manufacturing Corporation, New York, makers of various types of controls and other heating equipment.

## Contents


Terms Commonly Used in Heating.

Development of the Art of Heating.

Theory of Heat Radiation.

Artificial Heating as Related to Bodily Heat Losses.

The Measurement of Comfort.

Determining the Mean Radiant Temperature.

Temperature Studies in Radiant Heated Rooms.

Radiant Heating with Ceiling Panels.

Radiant Heating with Floor Panels.

Use of Wall Panels, Metal Panels, and Electricity.

Air Venting and Flow Adjusting.

Controls for Radiant Heating.

Areas and Surface Temperatures of Radiant Heat Panels.

Determining Panel Pipe Size, Spacing and Heat Input.

Radiant Cooling and Air Conditioning.

Snow Melting by Embedded Pipes.

Step-by-Step Procedure in Radiant Heating Design.


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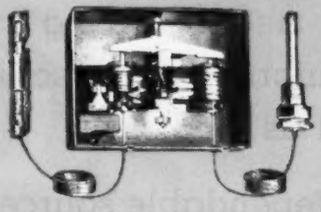
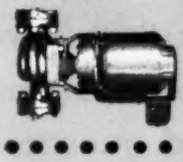


Series 90 Comfort Controller balances supply water temperature to outdoor temp. changes.

Hoffman Control Valve admits boiler water to circulating steam as needed.



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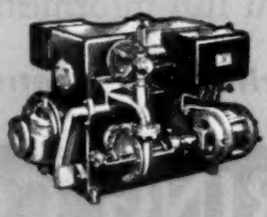

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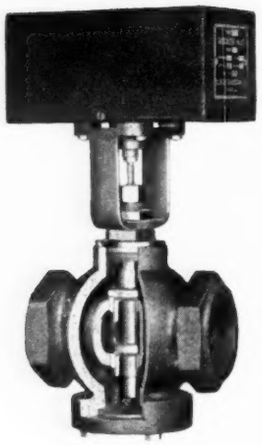

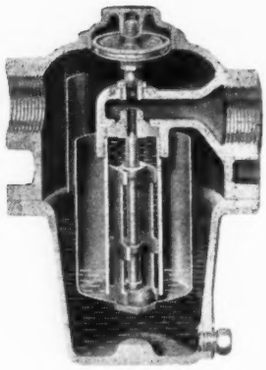

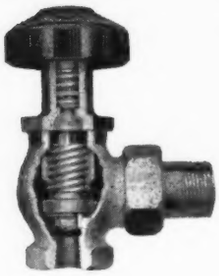

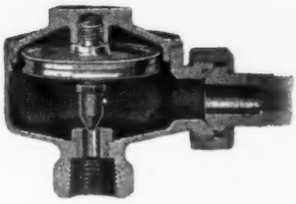

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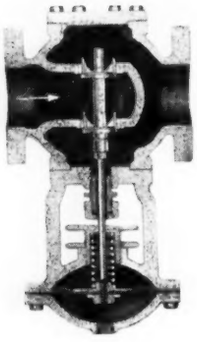
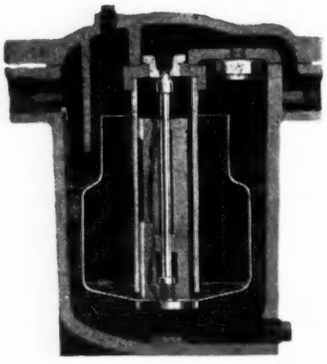


Illinois Control Equipment includes Combustion Control, Flow Control (electrical or pneumatic), Zone Control and a complete line of steam heating and power specialties for heating comfort and fuel saving and for industrial process control as well.



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# Sam, you better SCRAM!

## . . . 47 for '47 . . .

Here you have the big three of McDonnell products — the three controls that serve the broadest needs in protecting boilers from low water troubles. They have come a long way together. They were good from the start, but not nearly as good as they are today. During every one of the years we have been making them we have been watching for ways and finding ways of making them better. Thus they are the development of the greatest of all laboratories — the laboratory of *use*. No other boiler water level controls have been so widely used, so thoroughly tested, or so painstakingly perfected.

We list the No. 47 first because it is the answer to boiler water level control in the big field of low pressure boilers up to 5000 sq ft. capacity. For automatically fired boilers the No. 47 with low water cut-off switch (No. 47-2) makes the boiler water level as automatic as the firing — feeds water to automatically maintain the level under all normal conditions — stops the burner during an emergency such as extreme priming and foaming or failure of water supply.

Also popular for the low pressure automatically fired boilers is the No. 67 Low Water Cut-off — the most dependable means of cutting current to the burner when the water level falls too low. It meets the requirements of boiler owners who are not willing to pay for a completely automatic feeder cut-off combination like the No. 47-2.

Outstanding in the high pressure field is the No. 150. Here you have a basic unit which can be used as a low water fuel cut-off, as a feed-pump control, as a low water alarm switch, or for any combination of these uses — a control that is built down to the last detail to stand up in the presence of high pressure and extreme temperature.

These are the big three, but only three in the complete line covering all operating conditions. Ask for condensed catalog.

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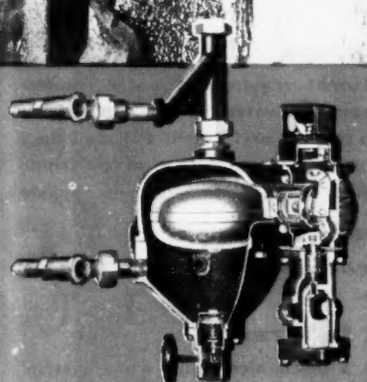
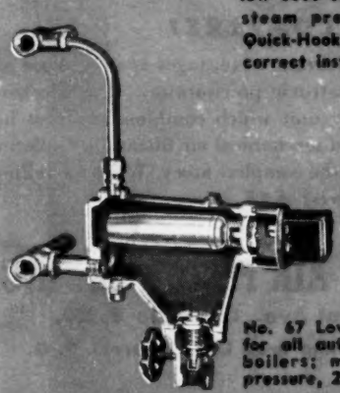
*Your Jobber Stocks Them*



**No. 47-2 Feeder-Cut-off Combination for boilers below 5000 sq. ft.; maximum steam pressure, 25 lbs. Quick-Hook-Up for speedy, correct installation.**



**No. 67 Low Water Cut-off for all automatically fired boilers; maximum steam pressure, 25 lbs.**

**No. 150 Water Level Control for boilers of any size with steam pressures up to 150 lbs. Used as feed-pump control; low-water fuel cut-off; low water alarm switch, or any combination of these functions.**

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## *Boiler Water Level Controls*

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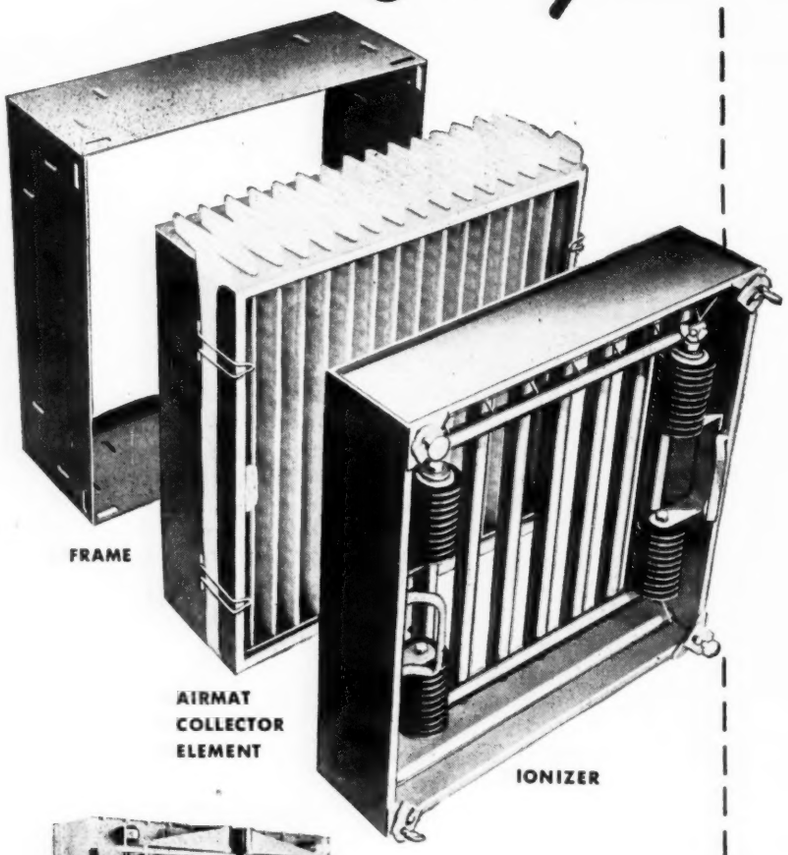
## serves you better 5 ways

**Exclusive AAF development combines top features of modern electronic precipitation and mechanical air filtration not found in any other type of electronic precipitator.**



Electro-Airmat
Size No. 253
Straight Bank Arrangement
Capacity 6000 CFM

**1. Easy, Positive Maintenance**

Airmat paper, a proved filtering media for the past 20 years, serves as the collector element. Electrostatic charging increases its dust holding capacity 30% but, when dust loaded, it is discarded and replaced quickly at small cost with clean paper to return unit to its original efficiency. There's no sludge to remove, no flushing of collector plates with water and no spraying with oil.

**2. Fireproof Design**

When using non-combustible Airmat paper, the Electro-Airmat eliminates all possible fire hazards. There is no oil film required to hold the collected material in place—no oiling by immersion or spraying—no sludge to accumulate.

**3. Simplified Installation**

The Electro-Airmat requires no water connections, sewer drains or water-tight base. Modern, compact design reduces unit weight 40% and floor area requirements 30% under that of electronic precipitators using metal plate collectors.

**4. High Operating Efficiency**

85% to 90% cleaning efficiency at normal precipitator velocities.

**5. Stops Dust Infiltration**

Functioning as a mechanical filter when system is shut down, the Electro-Airmat protects against dust infiltration due to "stack effect".

### COMPARE!

Check these 5 important advantages against those of other types of electronic precipitators. The Electro-Airmat is the only unit which combines the best in both electronic and mechanical air filtration. Bulletin No. 253 gives you the complete story. Write for it and name of your nearest AAF representative.

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**ELECTRONIC AIR FILTER**

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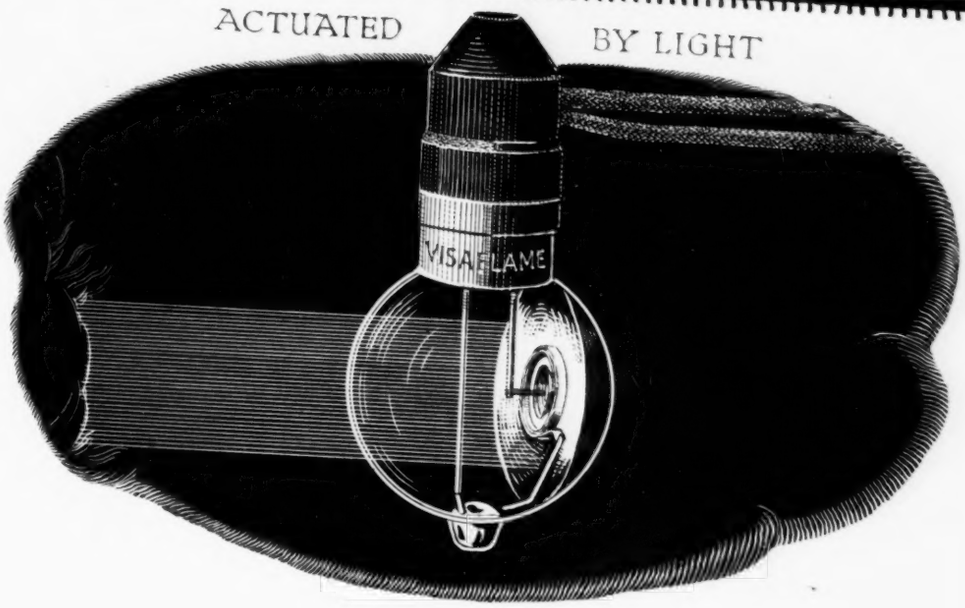


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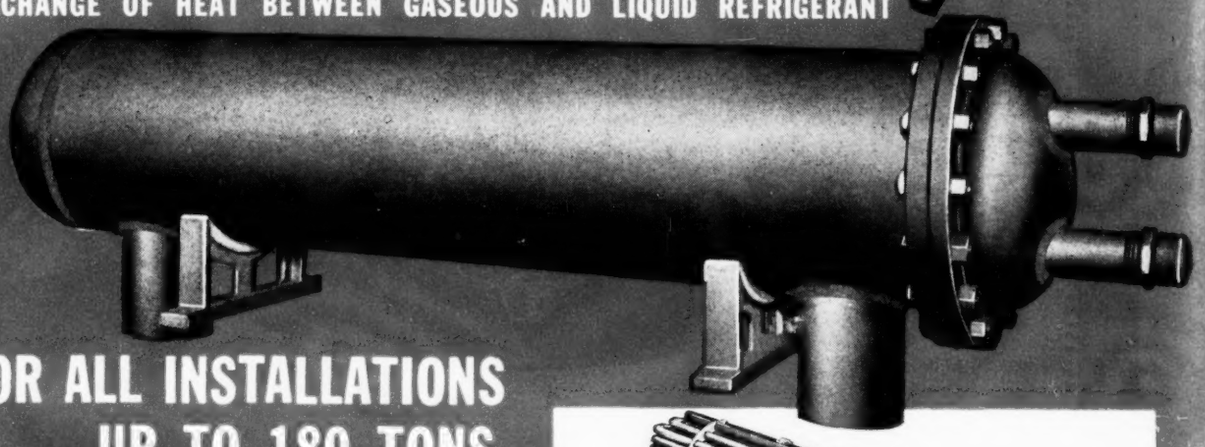

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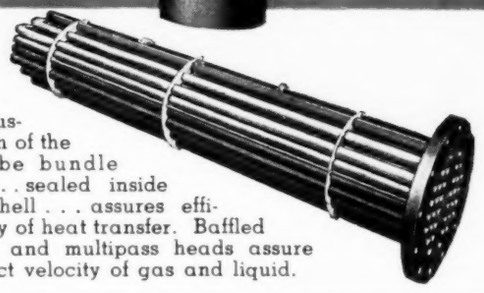

An illustration of the U-Tube bundle that . . . sealed inside the shell . . . assures efficiency of heat transfer. Baffled tubes and multipass heads assure correct velocity of gas and liquid.

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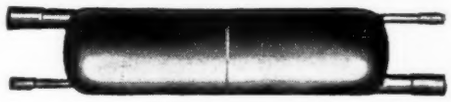

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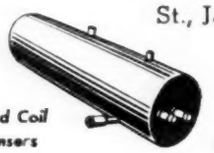
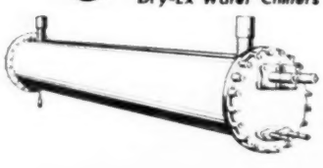


*Shell and Coil Condensers*



*Dry-Ex Water Chillers*

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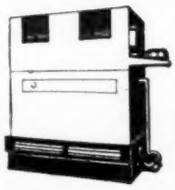


*Evaporative Condensers*

*Liquid Receivers*

# Washington News

LORING F. OVERMAN

THANKS to lengthy discussions of Appropriations Bills in Washington during May, legislators and lobbyists alike found themselves walking that very fine line that is supposed to mark the point where government functions may properly begin, and where they should end.

On the one hand were Republican senators and congressmen who, having taken the "time for a change" mandate seriously, are out to slash federal expenditures and reduce taxes—let the chips fall where they may.

Supporting them, yet sometimes not too sure as to the exact location of the proper dividing line, were those who wish to see government's functions curtailed —but without chopping off too many activities genuinely useful to business, agriculture, labor, education, the military, and so on.

In the middle were heads of government agencies, faced with reduced appropriations. It was through the appearance of these agency heads at appropriations hearings that members of Congress—many of them freshmen Republicans — learned of government activities undreamed of a few generations ago.

A case in point — and one of more than passing interest at the management and engineering levels of the heating, ventilating and air-conditioning industries —was the discussion of present and proposed functions of the Office of Technical Information and Services, a division of the Department of Commerce. At hearings on May 19 before the Senate Committee on Expenditures in the Executive Departments, fund custodians learned that activities of OTIS are by no means limited to the analysis, translation and dissemination of information concerning thousands of German patents seized following VE-day. (Patent-analysis functions of OTIS were outlined in this column for March, 1947).

Instead, legislators learned that the post-war function of OTIS is to serve as an over-all clearing house for technical information originating in several Government departments.

William C. Foster, Under Secretary of Commerce, explained that under OTIS, there is now within government for the first time a central agency to which businessmen may apply in seeking information needed as a solution to technical problems. He explained the set-up of OTIS as follows:

The Technical Industrial Intelligence Service—making available to American business the hitherto secret, confidential or restricted technical developments made during the war and applicable to the production of peacetime products;

The Research and Development Division—engaged in seeking solutions to important problems of industry for which the technical answers are not already available but may be found by relatively rapid and intensive applied research projects;

The Technical Inquiries Service—consisting of a small staff of engineers and technicians, handling general technical inquiries from business;

The National Inventors Council—established in the defense period prior to World War II as an aid to the Armed Forces in enlisting the assistance of inventors in solving important military problems.

## Cites Agricultural Research

In summarizing the Department of Commerce position in recommending appropriations for OTIS, Mr. Foster observed:

"First: The federal government has always played a relatively small role in the fields of research which have industrial applications, as compared with agricultural research, which is largely supported with public funds. Nevertheless, in its various technical agencies the federal government has an important and growing store of non-secret technical information which has always been used by a small proportion of business firms and which ought to be made more generally available to all business through some sort of a central clearing house.

"This clearing house service, which the department has been attempting to provide through the Office of Technical Services, will be of value to all business; but realistically, of course, it is of greatest value to the smaller firms which cannot support much of a research staff or laboratory facilities of their own. The really large corporations have extensive research facilities and in addition have been in a position to locate and utilize existing governmental information on their own initiative.

"Second: There are important technical problems in industries which consist of small and scattered firms—as, for example, in the construction industry—that private research facilities are maintained by practically none of them and technical progress is slow. Where such industries are affected with an important public interest—as in the construction industry—it seems to be good public policy to invest relatively small sums of public funds to stimulate cooperative research projects with industry which show promise of major improvements, savings in cost, and widespread general public benefits."

## Housing Research

Typical of the construction research projects referred to by Mr. Foster are those conducted by the National Housing Agency in collaboration with the National Bureau of Standards, the Forest Products Laboratory, the American Standards Association, the American Society for Testing Materials, the American Concrete Institute, the Bureau of Reclamation of the Department of the Interior, and the American Iron and Steel Institute, among others.

**WING REVOLVING UNIT HEATERS**

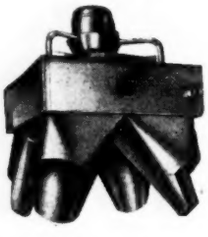
**DESIGN No. 4**—For buildings with heights above the average. Outlets can be set to different angles of discharge, insuring complete coverage of the area to be heated. Total air volume is delivered in two streams at velocities which permit maximum installation heights. In summer, with steam off, revolving outlets provide an equally pleasing cooling effect. Consult Bulletin HR-4.

**WING REVOLVING UNIT HEATERS**

**DESIGN No. 8**—The entire lower part (the discharge outlets) revolves slowly to distribute the comfortably warmed air over entire area. Machinery, merchandise, etc., cannot obstruct constantly moving air stream as they may with single-direction air stream from fixed discharge heaters. Design illustrated is for very high ceilings as in foundries, mills, factories. Consult Bulletin HR-4.

**WING REVOLVING UNIT HEATERS**

**DESIGN No. 5**—Third in a series of revolving unit heaters designed for buildings of average and lower-than-average roof heights. Four adjustable outlets give thorough heat distribution. All Wing Unit Heaters are installed as close as possible to roof or ceiling to prevent accumulation of high-temperature air at that point. Bulletin HR-4.

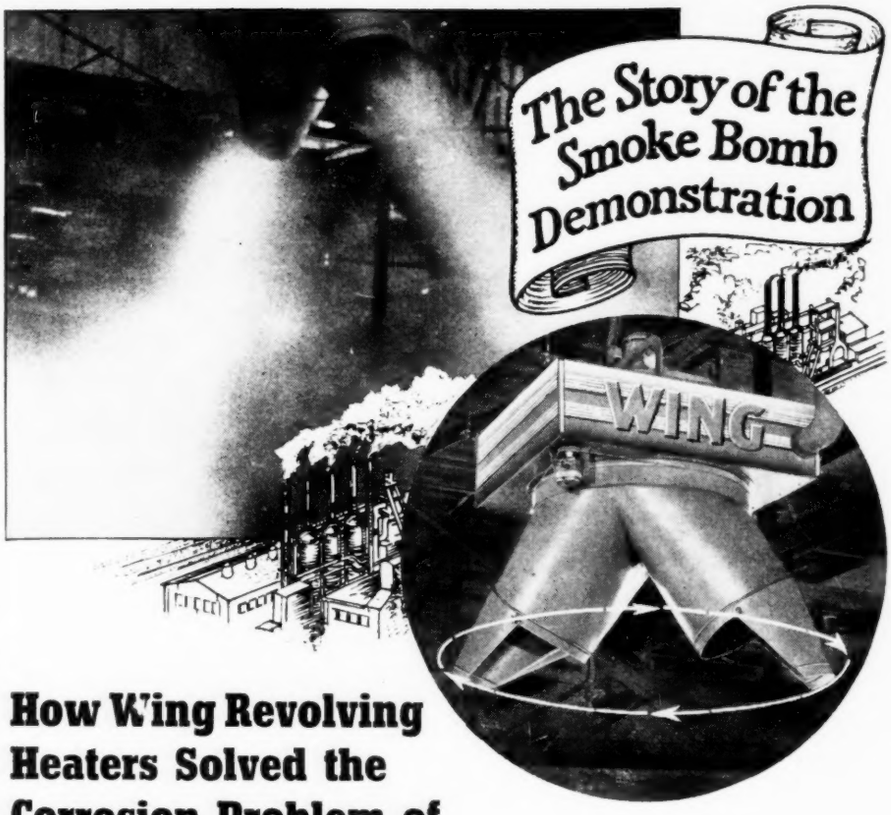


**WING FIXED DISCHARGE UNIT HEATERS**

**HIGH CEILING TYPE**—Similar to the Wing Revolving Unit Heater, but the discharge outlets do not revolve. Many buildings have certain areas which, due to their shape, cannot use to advantage Revolving Unit Heaters or which do not require highly uniform heating. For these, a complete line of Fixed Discharge Heaters is made with different outlets to suit the areas covered. A LOW CEILING TYPE is also available for installations involving low ceilings or roofs. Bulletin H-8.

**WING UTILITY UNIT HEATERS**

Used where wide distribution of heat is not essential. Discharge is horizontal with individually adjustable reflector vanes. Supplied with either constant or variable speed motors, the latter for installation in offices, churches, stores or other places where extremely quiet operation is essential. Bulletin U-7.




# How Wing Revolving Heaters Solved the Corrosion Problem of a Cold Strip Steel Mill

A LARGE eastern steel plant had a serious heating problem. In a storage building 112′ x 75′ with 34′ truss height, heated by nearly 4,000,000 Btu/hr wall type heaters, thermostatically controlled, they were continually losing hundreds of dollars worth of finished steel through corrosion.

A Wing sales engineer claimed that the "sweating" which caused the corrosion could only be eliminated by uniformly moving warm air over the entire floor. He offered to demonstrate how Wing Revolving Heaters could accomplish this by using 3 minute smoke bombs to cover the entire area around each pile of cold strip and to dissipate this blanket of smoke in 3 more minutes after the bombs were out.

Two Wing Revolving Heaters were installed and 3 bombs were set off over the fan inlets. The results were perfect. A blanket of smoke covered every pile of strip thoroughly and uniformly, and three minutes after the bombs were out, the smoke was as uniformly dissipated.

These two heaters deliver 2,039,350 Btu/hr giving 70° F. room temperature at 0° F. outside and with one air change per hour. Temperature difference between floor and roof truss varies only from 1° to 2° F.

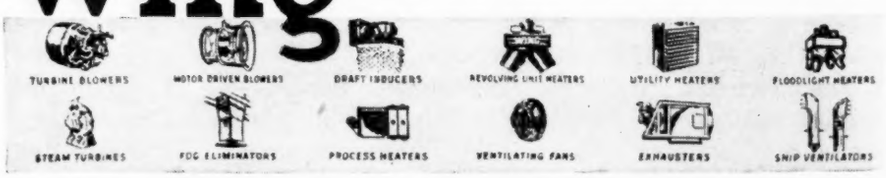
They have never lost a coil of cold strip since the Wing Revolving Heaters were installed.

Write for Bulletin HR-5

**L. J. Wing Mfg. Co.**, 158 W. 14th St., New York 11, N. Y.

*Factories:* Newark, N. J. and Montreal, Canada

**Wing REVOLVING UNIT HEATERS**



Tripling of the output of the nation's construction plant will require, the researchers believe, utilization of many new techniques of building, as well as the more leisurely site-building methods generally employed. Industrialized or factory built homes, says William V. Reed, director of the technical office of the National Housing Agency and the Office of the Housing Expediter, can be built efficiently, quickly, and inexpensively enough to fit the average family's pocketbook if the latest scientific discoveries and methods of production are applied.

### Codes Again

"The task is a large and complex one, requiring analysis, testing, and development of a large number of new types of houses and materials," said Mr. Reed. "It must also encourage the removal of innumerable restrictions against the use of such innovations in existing building codes. More than half of the American people live in 2,000 areas covered by building codes. The average code is written in terms of materials specifications, rather than performance standards. This means that many communities do not permit the use of new applications of standard materials or new techniques of engineering and construction. A man's home is composed of floors, walls, ceilings, roof, equipment and performance. Any material which does the job it is supposed to do in terms of performance should be permitted, the technical office believes."

In a preliminary move toward simplified standards, NHA has joined with the National Bureau of Standards in developing a document entitled, "Building Code Requirements for New Dwelling Construction."

### Performance Stressed

Standards for structural performance under live load, concentrated load, impact load, wind and snow loads, vertical and racking loads, and so on, have been set forth as a guide to manufacturers, testing laboratories, building officials, and code authorities. If these performance requirements are adopted, a builder, instead of having to use particular material of a specified thickness for a given purpose, will be free to use any material or construction system that passes the performance requirements for the purpose.

One branch of the building industry, however, needs a completely new uniform code. This is the plumbing industry.

### Uniform Plumbing Code

An electrical code is generally accepted throughout the nation, but no such code exists for the plumbing industry. There are over 1,500 different local, county, and state plumbing codes in America. NHA's technical office is sponsoring a coordinated effort to answer the most controversial questions about plumbing performance. A uniform plumbing code committee has been organized, composed of representatives of the leading private and public organizations in the field, including labor, industry, and Government, and the Bureau of Standards had been assigned the job of running comprehensive analyses of the toughest problems in the industry.

"Nation-wide code revision is bound to be a long, slow process," said Mr. Reed. "It will take endless persuasion, arguments, and public pressure to bring about adoption of such drastic changes in existing local practices as both the performance standards and the plumbing code require. Meanwhile the housing need is great, and will not wait upon the social and economic reorganization required by the new codes."

### Construction Lagging

Meanwhile the current housing program appears to be falling somewhat behind the goal of 950,000 residential units previously estimated as this year's total. About 700,000 per year is the present rate, with enough starts to keep July, August and September very busy. Observers agree that the lag will make itself felt in the fourth quarter.

Industrial and commercial building appears to be taking up its permitted $50 million per week authorized by the Office of the Housing Expediter, but if it is to be held to this limit until September, it is doubtful that it can take up the slack anticipated in the home building field. As a result, a number of shortages in the building field are expected to disappear within the next 60 to 90 days, with lumber leading the field.

### What Price Economy?

The current slowdown in the construction field again spotlights the question that has bothered legislators in the Appropriations Hearings. At just what point does government assistance ceases assisting; at what point does it interfere? While it would seem that there is a need for wider dissemination of technical information and for research of the types needed to speed the utilization of new construction methods, there are those who blame the housing lag on government interference. Somewhere between these two positions must lie the answer. May the searchers find it in their quest for the balance line between government and industry!

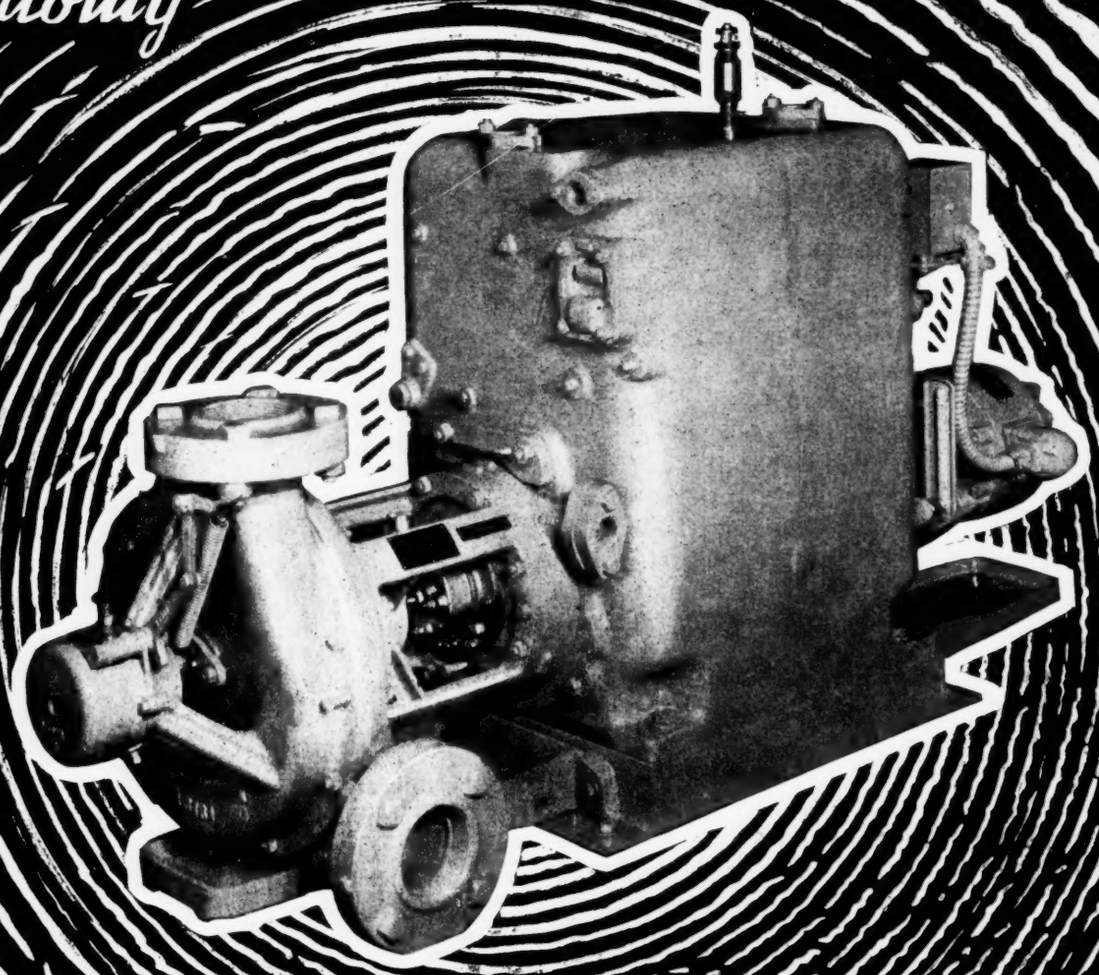
### A-C Surface Scratched

Whether or not the Department of Commerce gets all of the funds it is seeking, its appropriations held out long enough to give the Air Conditioning industry a bit of free publicity in the May issue of its monthly publication.

### Domestic Commerce

Discussing the outlook for air conditioning, Howard E. Way, Machinery and Metals Section, Office of Domestic Commerce, commented that comfort air conditioning is becoming increasingly popular and is becoming to be accepted as a necessity. He referred to A-C as the next "Billion Dollar Industry."

# Centralized Heating Economy



## A RETURN LINE VACUUM PUMP THAT CUTS HEATING COST.

This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
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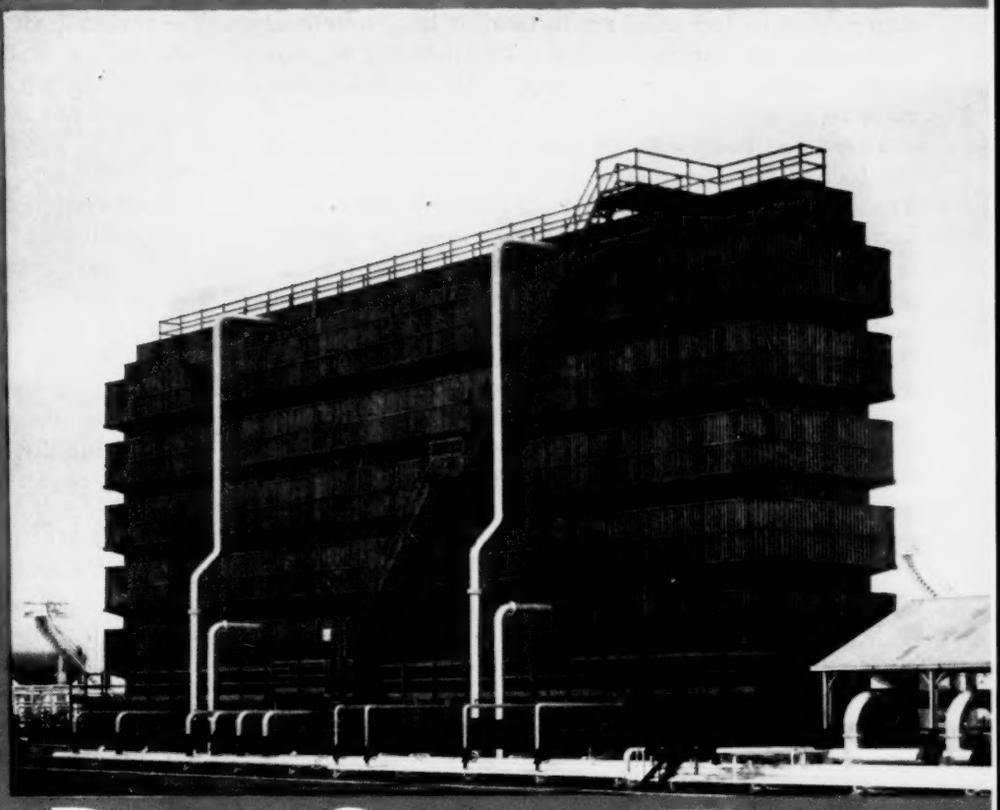
HEATING AND VENTILATING



# Evaluating Performance of the Mechanical Draft Cooling Tower

JAMES G. DeFLON

Chief Cooling Tower Development Engineer, The Fluor Corp., Ltd.

**This is a discussion of the various factors that influence performance of forced and induced draft cooling towers. Data, curves and illustrative problems for estimating performance are included.**

PROCESSES for cooling water are among the oldest and simplest known to man. All that is required to cool water is to expose its surface to air. Some cooling processes are slow, such as the cooling of water on the surface of a pond; others are comparatively fast, such as the spraying of water into air. These processes all involve the exposure of water surface to air with varying degrees of efficiency.

Heat transfer involves a latent heat addition due to change of state of a small portion of the water from liquid to vapor and a sensible heat transfer due to the difference in temperature of water and air. Approximately 1,000 Btu are required to evaporate one pound of water, which is the amount of heat lost in cooling 100 lb of water 10F. Therefore, for each 10F of cooling effected, roughly 1% of water is lost by evaporation. In addition, there will be a spray loss of not more than 0.2% in a well-designed atmospheric or mechanical draft tower. For example, water cooling from 120 to 90F will therefore lose 3.2% of its weight (3 plus 0.2%) with each passage through the tower.

In cooling towers in which the water is warmer than the air, the heat removed from the water ($q_t$) and transferred to the air is the sum of the sensible heat ($q_s$) and the latent heat of evaporation. The sensible heat is small compared to the latent heat transferred,

$$q_t = q_s + w_r$$

It is therefore evident that the water cannot be cooled below the wet bulb temperature of the entering air. The wet bulb temperature or the adiabatic saturation temperature represents the minimum temperature that the water would reach with infinite time of contact between water and air in a cooling tower. This must be kept in mind when designing a plant to operate on cooling tower water.

## General Considerations

As process refinements have appeared, industry has demanded closer and closer control of its production units, resulting in more exacting demands upon cooling towers. In many plants, each additional degree of cooling has meant considerable daily monetary savings

represented by increased production. It has, therefore, been necessary for the cooling tower industry to produce a tower which would supply the colder water more economically.

There are two types of cooling towers in general use today—the atmospheric and the mechanical draft. The spray pond and natural draft chimney tower have been largely replaced by those two types of cooling towers. Objection to the spray pond is the limited performance available and the nuisance created by the high water loss during certain seasons of the year. Objection to the natural draft tower is the high initial cost and the serious reduction in performance experienced during periods of hot weather.

Both the atmospheric and the mechanical draft towers are capable of cooling water to the same minimum temperatures. The economic situation, the prevailing atmospheric conditions, the desired approach to the wet bulb temperature, and the amount of space available, will indicate which type to select.

## Mechanical Draft Towers

There are two types of mechanical draft towers in use today—the forced draft and the induced draft. The forced draft tower has its fan mounted at its base and the air is forced in the bottom and discharged through the top at low velocity. In the induced draft tower, the fan is mounted on the roof of the structure and air is pulled upward and discharged at a high velocity.

The forced-draft type is more often subjected to the recirculation of the hot humid exhaust vapors back into the air intakes than is the induced-draft type. This occurs under certain atmospheric conditions because the velocity of the humid exhaust air is so low that the suction created by the fans tends to draw this air back into the tower. Since the wet bulb temperature of the exhaust air is considerably above that of the ambient air, there is a decrease in performance evidenced by an increase in cold water temperature.

Except for fan location, the structural and operational features of the two types of mechanical draft towers are essentially the same. A cross-section of the induced-draft tower with the various parts labeled is shown in Fig. 1. Entrained moisture is removed from the exhaust air by the drift eliminator just above the spray chamber and below the fan. Water is pumped to the main header at the top of the tower and from there distributed to the various nozzles. This water is sprayed up in a manner similar to that used in a spray pond and is intimately mixed with the exhaust air before dropping to decks below. In performance, the upspray distributing system represents the equivalent of adding 8 or 9 ft to the height of the cooling tower over that of the gravity-type system. Slat-type grids interrupt the water as it flows counter-currently to the air. In flowing counter-currently, the coldest water contacts the driest air and the warmest water contacts the most humid air. Maximum performance is thus obtained since the cold water temperature approaches the wet bulb temperature of the entering dry air. This was not true of the older cross-flow and parallel-flow type cooling towers.

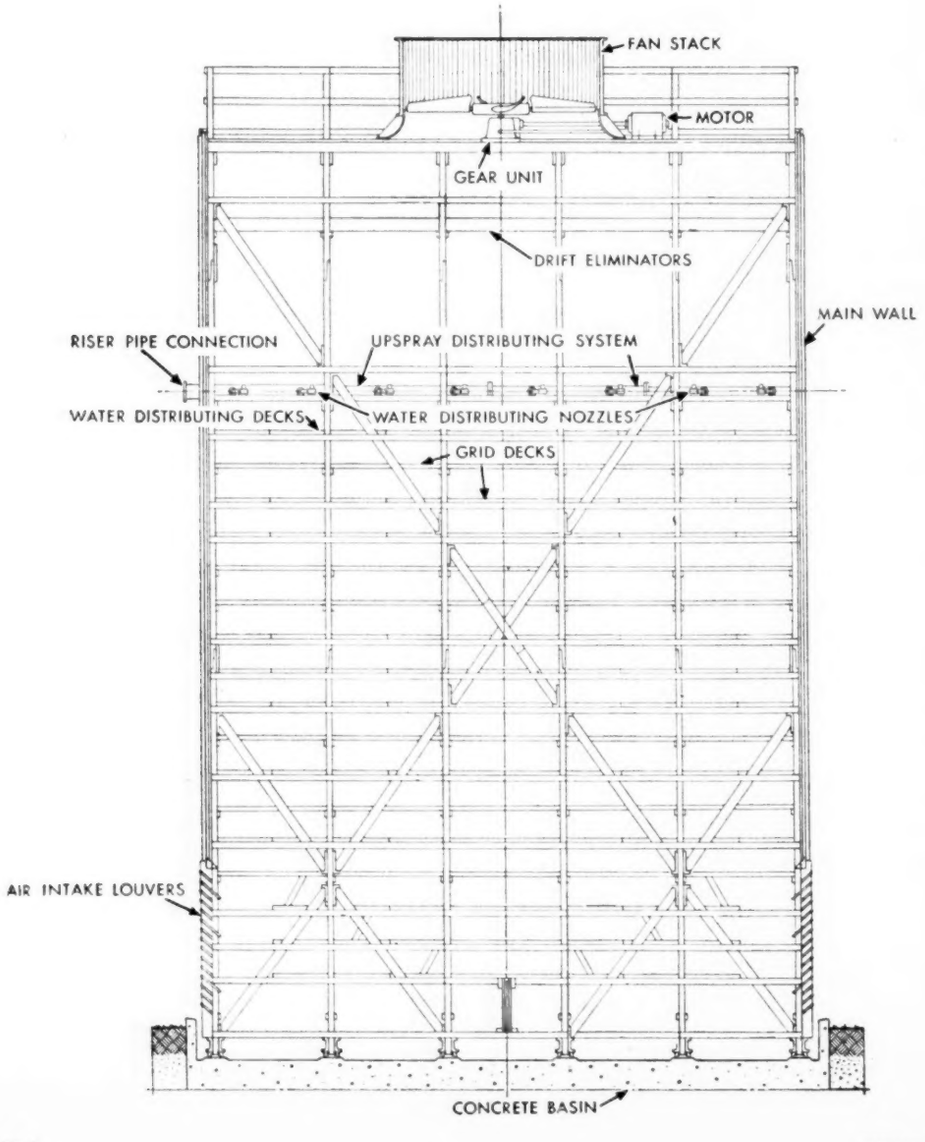



Fig. 1. Cross section of a mechanical draft cooling tower. With an upspray distributing system, sufficient space must be allowed between drift eliminators and nozzles for a spray chamber. Exterior is shown in Fig. 2.

Performance of a given type cooling tower is governed by the ratio of weights of air to water and the time of contact between water and air. In commercial practice, variation in the ratio of air to water is first

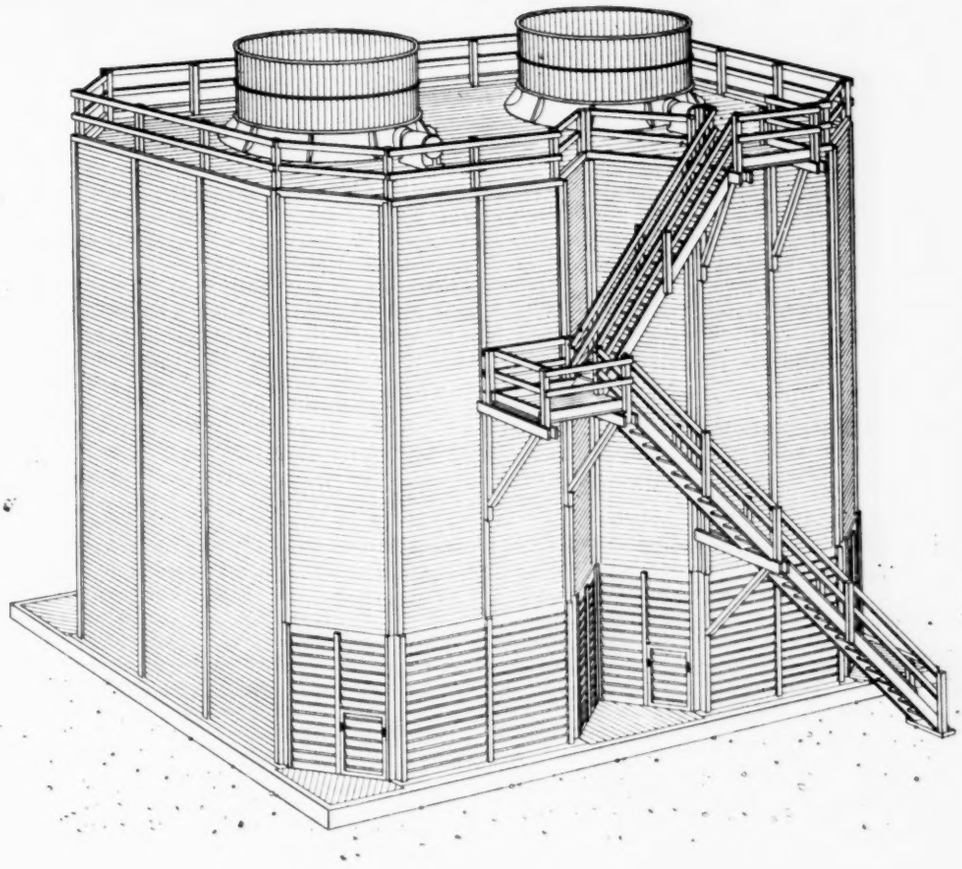


Fig. 2. A modern two-cell mechanical draft cooling tower.

obtained by keeping the air velocity constant at about 350 fpm per sq ft of active tower area and varying the water concentration (gpm per sq ft of tower area). As a secondary operation, the air velocity is varied to make the tower accommodate the cooling requirement.

Time of contact between water and air is governed largely by the time required for the water to discharge from the nozzles and fall through the tower to the basin. Time of contact is therefore obtained in a given type unit by varying the tower height. Should contact time be insufficient, no amount of increase in the ratio of air to water will produce the desired cooling.

Therefore, it is necessary that a certain minimum height of cooling tower be maintained. Where a wide approach of 15 to 20F to the wet bulb temperature and a 25 to 35F cooling range is required, a relatively low cooling tower will suffice. Approach is the difference between the cold water temperature and the wet bulb temperature. Cooling range is the difference between the hot water temperature and the cold water temperature.

A tower in which the water travels 15 to 20 ft from the distributing system to the basin is sufficient. Where a moderate approach of 8 to 15F and a cooling range of 25 to 35F is required, then a tower in which the water travels 25 to 30 ft is adequate. Where a close approach of 4 to 8F, with a 25 to 35F cooling range is required, then a tower in which the water travels from 35 to 40 ft is necessary. While it is usually not economical to design a cooling tower with an approach of less than 4F, it can be satisfactorily accomplished with a tower in which the water travels 35 to 40 ft.

Fig. 3 shows the relationship of the hot water, cold water and wet bulb temperatures to water concentration. From this, the minimum area required for a given performance of a well-designed counterflow induced draft cooling tower can be obtained. The horsepower per square foot of tower area required for a given performance is given in Fig. 4. These curves do not apply to parallel or cross-flow cooling since these processes are not as efficient as the counterflow process. Also they do not apply where the approach to the cold water temperature is less than 5F. They should be considered approximate and for preliminary estimates only. Many factors not shown in the graphs must be included in the computation and hence the manufacturer should be consulted for final design recommendations.

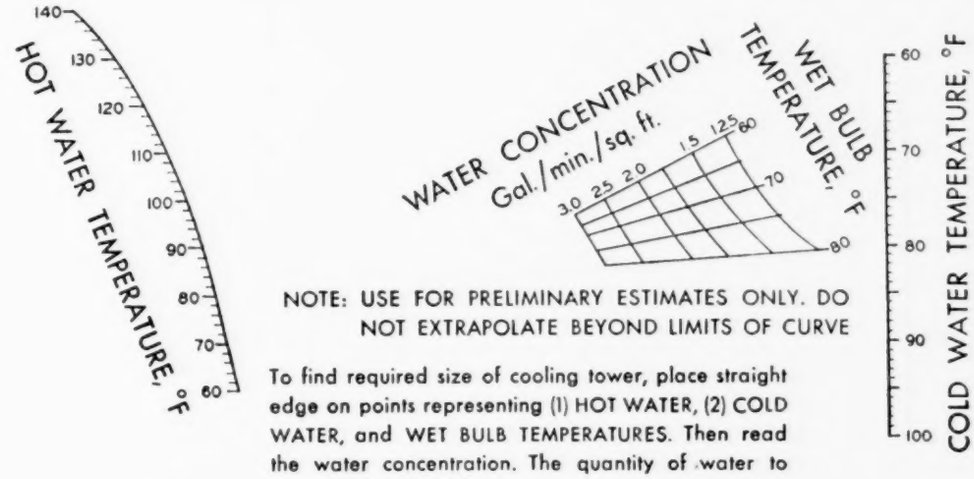



Fig. 3. Sizing chart for mechanical draft cooling tower.

The cooling performance of any tower containing a given depth of filling varies with the water concentration. It has been found that the maximum contact and performance are obtained with a tower having a water concentration of 2 to 3 gpm per sq ft of ground area. Thus, the problem of calculating the size of a cooling tower becomes one of determining the proper concentration of water required to obtain the desired results. A higher tower will be required if the water concentration falls below 1.6 gal per sq ft. Should the water concentration exceed 3 gal per sq ft, a cooling tower of less height may be used. Once the necessary water concentration is obtained, the tower area can be calculated by dividing the gallons per minute circulated by the water concentration in gallons per square foot. Required tower size then is a function of the following:

1. Cooling range (hot water temperature minus cold water temperature).
2. Approach to wet bulb temperature (cold water temperature minus wet bulb temperature).
3. Quantity of water to be cooled.
4. Wet bulb temperature.
5. Air velocity through the cell.
6. Tower height.

To illustrate use of the charts, let us assume that we have the following cooling conditions:

| | |
|---|---|
| Hot water temperature | 102F |
| Cold water temperature | 78F |
| Wet bulb temperature ($T_{wb}$) | 70F |
| GPM | 2000 |

Place a straight edge on Fig. 3 to connect points representing the design water and wet bulb temperature. We find that a water concentration of 2 gal per sq ft is required. Dividing the quantity of water circulated by the water concentration, we find that the theoretical area of the tower is 1,000 sq ft.

**Table 1 – Nozzle Capacity**

| Nozzle Number | Pipe Size In. Dia. | Orifice Size In. Dia. | Pressure in Pounds per Square Inch | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 15 | 20 | 25 | 30 |
| | | | Capacity in U. S. Gallons per Minute | | | | | | | | | | |
| 2.4 | ⅜ | 7/64 | .. | .. | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.6 | 1.8 | 2.0 | 2.2 |
| 2.4 | ⅜ | 9/64 | 1.8 | 1.9 | 2.1 | 2.2 | 2.3 | 2.3 | 2.7 | 3.0 | 3.4 | 3.8 | 4.2 |
| 7 | 1 | 7/32 | 6.5 | 7.1 | 7.7 | 8.2 | 8.7 | 9.2 | 10.1 | 11.3 | 13.1 | 14.6 | 16.0 |
| 14 | 1 | ⅜ | 11.5 | 12.6 | 13.6 | 14.5 | 15.4 | 16.2 | 17.7 | 19.8 | 22.7 | 25.3 | 27.8 |
| 19 | 1½ | 7/16 | 16.8 | 18.3 | 19.8 | 21.1 | 22.4 | 23.5 | 25.8 | 28.7 | 32.9 | 36.5 | 40.0 |
| 24 | 1½ | 1 | 20.0 | 22.0 | 23.8 | 25.3 | 26.9 | 28.3 | 31.0 | 34.7 | 40.0 | 44.8 | 49.0 |
| 39 | 2 | 1¼ | 33.0 | 36.2 | 39.0 | 41.8 | 44.3 | 46.7 | 51.0 | 57.0 | 65.8 | 73.3 | 80.0 |
| 49 | 2½ | 1 23/32 | 39.5 | 43.0 | 46.5 | 49.5 | 52.5 | 55.0 | 60.5 | 67.0 | 78.0 | 86.0 | 94.0 |

To obtain the theoretical fan horsepower, we use Fig. 4. Connect points representing the 100% of standard tower performance with the turning point, we find that it will require 0.041 hp per sq ft of actual effective tower area. Multiplying this by the tower area of 1,000 sq ft, we find that 41.0 fan horsepower are required to perform the necessary cooling.

Suppose that the commercial tower size is such that the actual tower area is 910 sq ft. We can still obtain the cooling equivalent to 1,000 sq ft of standard tower area by increasing the air velocity through the tower. Within reasonable limits, the actual area shortage can be compensated for by an increase in air velocity through the tower which, in turn, requires a higher fan horsepower. Our problem then becomes one of increasing the performance of the smaller tower by 10%. From Fig. 4, by connecting the points representing 110% of standard tower performance and the turning point, the fan horsepower is found to be 0.057 hp per sq ft of actual tower area, or 0.057 × 910 = 51.9 hp.

On the other hand, suppose the commercial tower size is such that the actual tower is 1,110 sq ft, the cooling equivalent to 1,000 sq ft of standard tower area can be accomplished with less air and less fan horsepower. By the use of Fig. 4, the theoretical fan horsepower for a tower doing only 90% of standard performance is found to be 0.031 per sq ft of actual tower area or 34.5 hp.

This illustrates how sensitive the fan horsepower is to small changes in tower area. The importance of designing a tower which is slightly oversize in ground area becomes immediately apparent.

Let's assume that we have the same cooling range and approach as used in the first example, except that the wet bulb temperature is lower. The design conditions would then be: Gpm, 2,000; range, 24F; approach, 8F; $T_1$, 92F; $T_2$, 68F; wet bulb temperature, ($T_{wb}$) 60F.

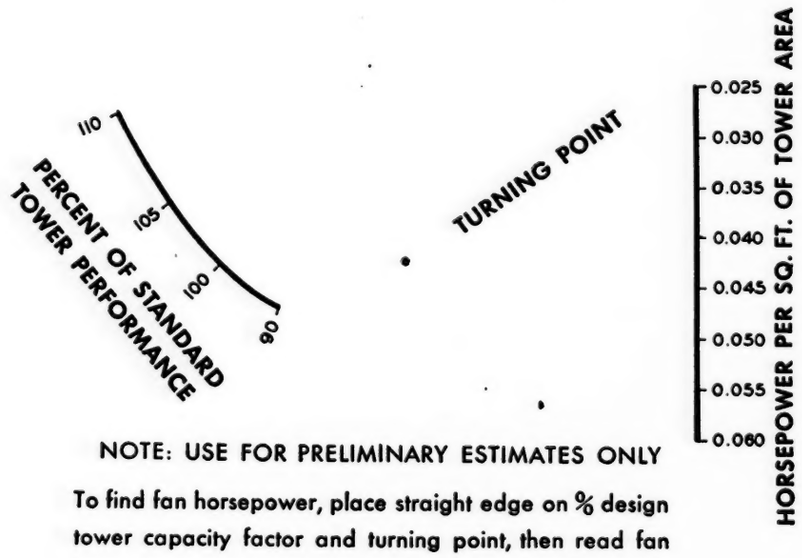

110
105
100
95
PERCENT OF STANDARD TOWER PERFORMANCE
TURNING POINT
0.025
0.030
0.035
0.040
0.045
0.050
0.055
0.060
HORSEPOWER PER SQ. FT. OF TOWER AREA
NOTE: USE FOR PRELIMINARY ESTIMATES ONLY
To find fan horsepower, place straight edge on % design tower capacity factor and turning point, then read fan horsepower per square foot of tower area at right. Multiply tower area by this factor to obtain fan horsepower.

Fig. 4. Fan horsepower curve for mechanical draft cooling towers.

From Fig. 3, we find the water concentration required to perform the cooling is 1.75, giving a theoretical tower area of 1,145 sq ft as compared with 1,000 sq ft for a 70F wet bulb temperature. This shows that the lower the wet bulb temperature for the same cooling range and approach, the larger the tower area required. Therefore, the more difficult is the cooling job.

Estimating the performance of an existing tower, at other than design conditions, is often required. For example, suppose we have a tower that was designed for the following conditions: Gpm, 1,000; range, 30F; approach, 10F; $T_1$, 110F; $T_2$, 80F; wet bulb temperature, 70F.

What will the cold water temperature $T_2$ be when the wet bulb temperature $T_{wb}$ drops to 60F, providing that the heat load and water quantity remain constant? From Fig. 3, we find that the water concentration is 2.0 gal per sq ft at design conditions. This water concentration does not change since the volume of water and the tower area remain constant. With the water concentration at 2.0 and the wet bulb temperature at 60F, by adjusting the angle of the straight edge in Fig. 4 until we obtain a 30F differential between the hot water and cold water temperatures, we find the hot water temperature to be 103F, and the cold water temperature to be 73F.

Suppose now, that the above designed tower had 1,500 gpm flowing through it, and the total heat load remained constant, what would the cold water temperature be when the wet bulb temperature is 65F?

Design heat load was $1000 \times 8.33 \times 33 = 250{,}000$ Btu per minute. The new cooling range (heat load remaining constant) when recirculating 1,500 gpm over the tower would be

$$\frac{250{,}000}{1500 \times 8.33} = 20.0\text{F}$$

Theoretically, the design area of the tower from Fig. 3 was 500 sq ft (1000 gpm/2.0 gal per sq ft = 500 sq ft). Water concentration when circulating 1,500 gpm is

$$\frac{1500}{500} = 3 \text{ gal per sq ft}$$

Now, referring to Fig. 3, with a water concentration of 3.0 gal per sq ft and 65F wet bulb temperature, adjust the straight edge until a difference of 20F exists between the hot water and cold water temperatures. This shows the hot water temperature to be 100F and the cold water temperature to be 80F.

It indicates that the possibility of a lower cold water temperature obtained by the lower existing wet bulb temperature was lost due to the adverse effect of the increased water quantity.

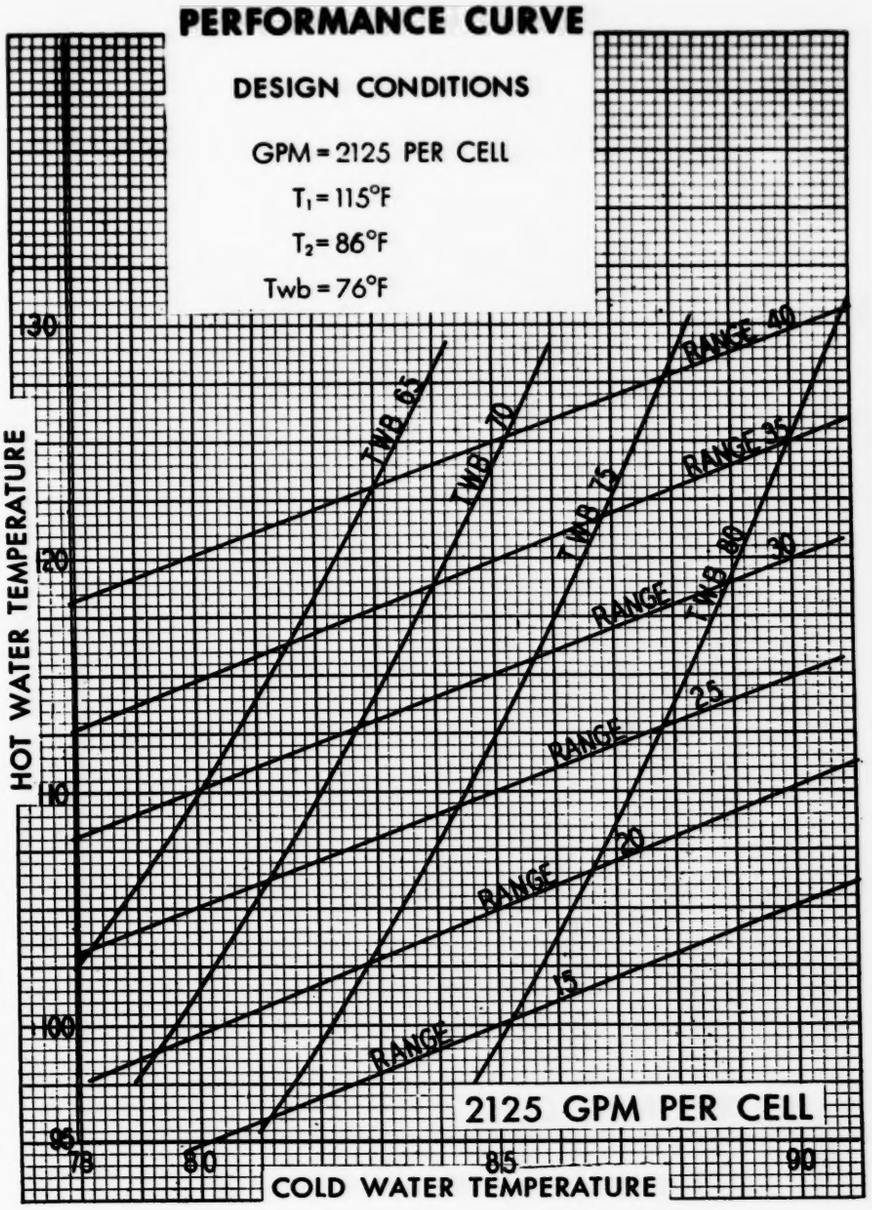



Fig. 5. Typical performance curve.

Fig. 5 gives the type of performance curve furnished by the cooling tower manufacturer. It shows performance variation with change in wet bulb and hot water temperature, while maintaining the water quantity constant.

### Cooling Tower Spray Nozzles

Table 1 gives the performance of a particular family of nozzles. This nozzle is of the non-clogging type. It does not depend on small orifices to obtain minimum drop-size but rather, upon centrifugal force. The water is given a spiral action by its tangential entrance into the spiral chamber. The dome-shaped approach to the discharge orifice increases this spiral action as it approaches the discharge orifice. This whirling action, which generates the necessary velocity for fine breakup, assures uniform drop-size and efficient water distribution over a maximum area. Formation of uniformly small drops assures maximum contact with air with resulting high cooling efficiency. In upspray distributing systems, while a pressure of 7 lb per sq in. is common practice, 5 lb is adequate.

# Air Volume Increased 64% by Simple Ductwork Changes

**JOHN CASSIE**
Research Engineer, B. F. Sturtevant Division of Westinghouse Electric Corp., Hyde Park, Mass.

**A case history of how a few changes in ductwork of a ventilating system resulted in an increase in air volume.**

FAN and ductwork connections at fan inlet and fan outlet are interdependent. This relationship was strongly brought out by a "sick" installation and by the steps necessary to make the required alterations.

The system that required corrective measures was installed to ventilate and heat the rifle range and swimming pool at a state university. The simple alterations that were made increased the air volume by 64%.

The calculated duct velocities were as dictated by rules considered good practice. Pressure losses of the straight duct runs, elbows, tapered sections and heating coils were taken from accepted handbooks and manufacturers' catalog. The complaint registered against the fan manufacturer, immediately after the installation was completed, was "the fan is handling less than two-thirds of the specified volume—in spite of the fact that the static pressure measured on the job is less than half the specified resistance."

Here is given a step-by-step account in the same sequence the incidents developed. The graphic story is given by curves of Fig. 1 and 2.

Data submitted by the customer as the results of his field tests are shown at *B* and *B'* of Fig. 1. Volume, static pressure and brake horsepower are plotted at 100% "as installed."

Had the fan speed been kept constant while the position of a system damper, remote from the fan, was varied, further field tests would have resulted in the "as installed" fan characteristics *DBE* for volume-pressure and *B'E'* for volume-brake horsepower. These two curves are then the loci of all combinations possible from that *installed* fan at that speed and air density.

A square-law curve (parabola) passing through the origin (test point *B* and point *C*) is the locus of all pressure-volume combinations possible through the existing physical system. Volume is altered either by speed variation of the fan or by substituting other fans for it.

It will be noted that the "as installed" volume (vertical line *BF*) is substantially less than "as specified" volume (vertical line *ACC'*).

If it were possible to increase the fan speed while maintaining the same physical system, we could, by trial, gradually continue this increase, with the volume and pressure gradually increasing along the system resistance curve *BC* to *C*. The system would then be handling the specified volume. The corresponding pressure would be *C* or about 269% of the "as installed" pressure.

Further, the brake horsepower corresponding to the speed increase would be a cube-curve from the origin, through *B'* toward *C'*. When the specified volume and the new pressure *C* are reached, the brake horsepower is *C'* or about 441% of the "as installed" horsepower. It is evident that such a speed increase could not be accomplished with the original motor and that the fan might not be of sufficient strength to stand the neces-

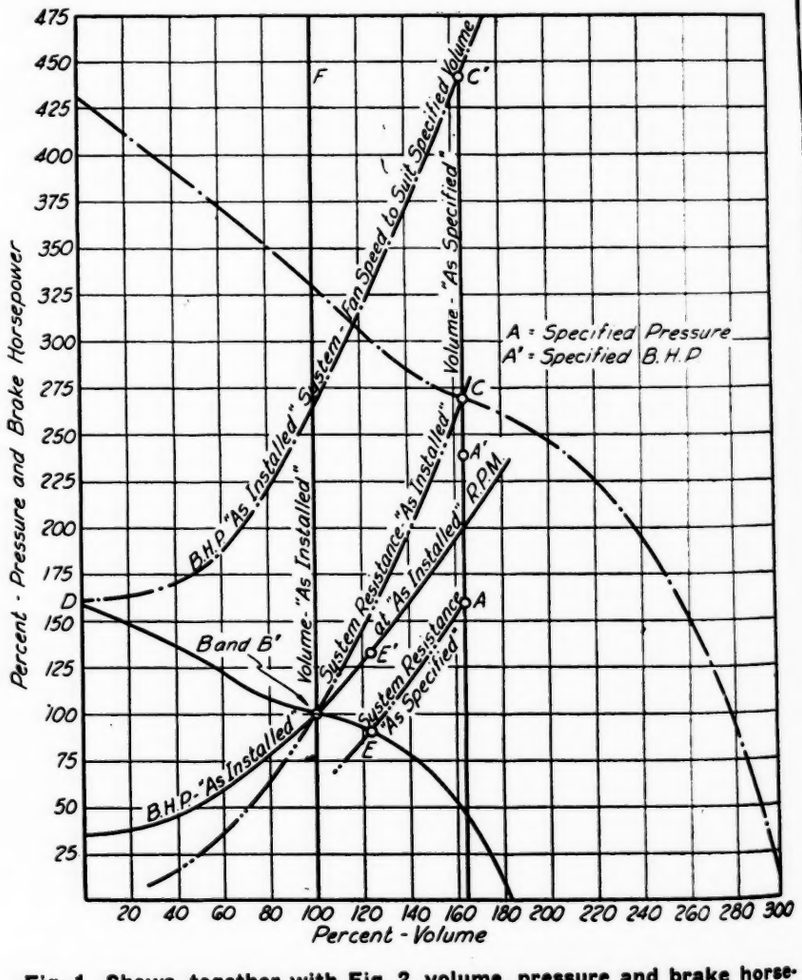



**Fig. 1. Shows, together with Fig. 2, volume, pressure and brake horsepower curves, of all possible combinations, from installed fan at constant speed and air density.**

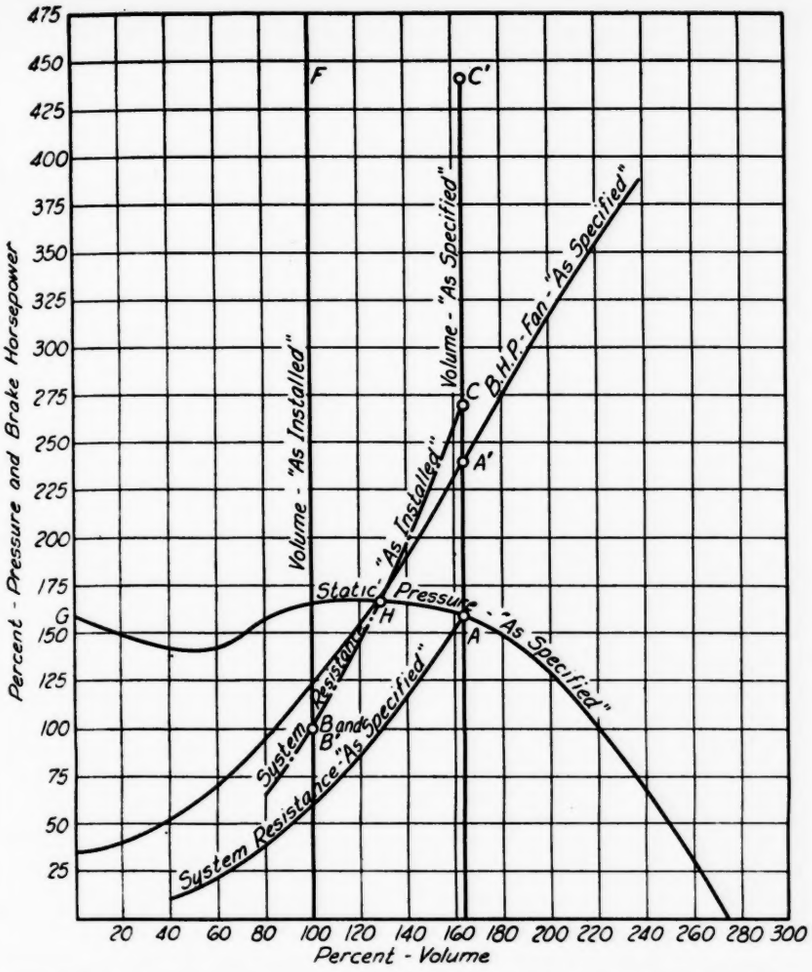



Fig. 2. Performance curves for installed fan at constant speed and air density supplementing curves shown in Fig. 1.

sary 64% speed increase. Some other means, which would not overload the original motor, was then sought. The specified volume must be evacuated from the serviced areas.

It will be noted on either Fig. 1 or 2, that the as installed system required pressure *C* or 269% to force the specified volume or 164% to flow; the specified system required only pressure *A* or 159% to force this same volume to flow. Thus, for a given volume, the as installed system had 69% excess resistance.

If the excess resistance were the only cause of volume deficiency, it can be seen from Fig. 2, that we would expect 129% volume and 167% pressure from the fan, as determined by the intersection of system resistance curve *CB* with the static pressure characteristic *GA* at *H*. However, there is actually a further decrease of volume and pressure *H* to *B* in Fig. 2 which must be accounted for by other than friction.

The actual performance point *B*, is the intersection of actual system resistance curve *CHB* and some *actual* as installed fan static pressure characteristic on which *B* is located. This fan pressure characteristic, is curve *DBE* of Fig. 1, and since the actual fan characteristic curve *DBE* differs greatly from the anticipated and specified characteristic *GHA*, the reason must be ferreted out.

To do this we must compare the as installed setup of the fan inlet and discharge duct connection with the corresponding elements on the test-code setup in the laboratory at the time when the basic fan catalog data were determined. Fig. 3 shows the points of difference. Inspection of the details of the fan wheel, fan casing and their relation to each other revealed no departure from the proportions of the laboratory-tested fan. Further, the pressure losses of the straight ducts, elbows, and heating coil *remote from the fan* checked those of the handbook and coil manufacturer, when due allowance was made for the fact that the volume flowing was unintentionally low.

Since, the installed fan discharge connection and duct were long and straight, as was the case in the laboratory test, the only remaining possible source of trouble was the ductwork connected to the intake side of the fan casing.

Fig. 3 shows the setup as installed. From the plan it will be seen that air streams from the two serviced areas merge with a crowding action, converging the common stream toward *A*. The side elevation shows the possibility of additional crowding toward *B* and contraction at *C*.

The common stream therefore enters the inlet chamber in a manner which practically utilizes the chamber as a cyclone collector instead of a fan inlet box. Calculated velocity obtained by dividing the handled volume by the cross-sectional area of the confining sheet metal duct does not determine the actual velocity. The combination of crowding at elbows and pre-spin at wheel entrance changes completely the performance of the laboratory fan to the poor performance as installed.

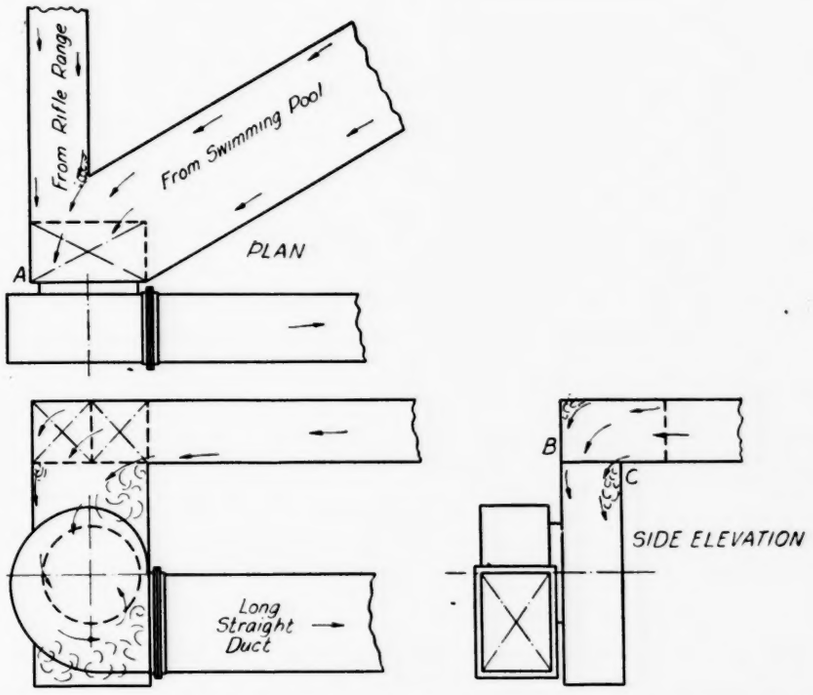
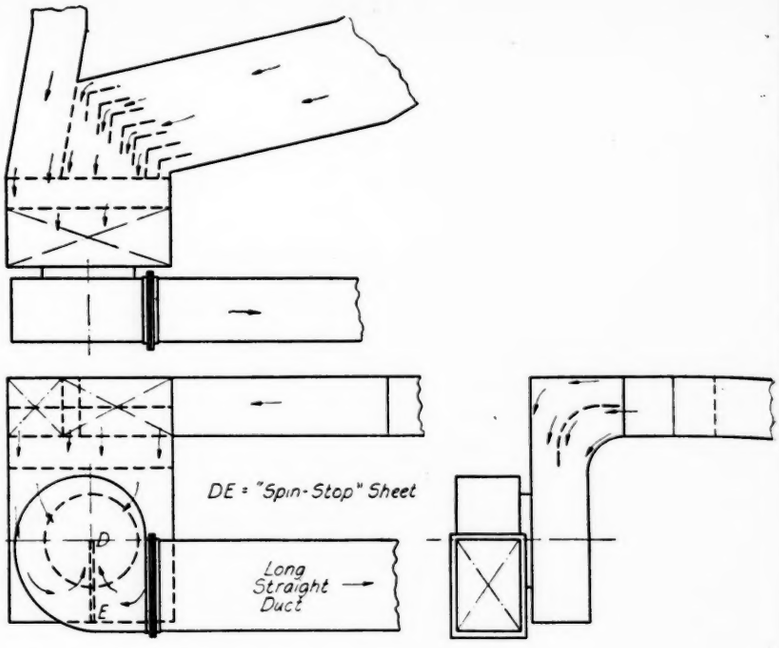



Fig. 3. Ductwork as installed showing crowding action and contraction at A, B and C.

Fig. 4. How system was corrected by simple sheet metal alterations.




While the excess pressure loss is quite readily understood, the effect of spin at the fan inlet is less readily appreciated. However, a moment's reflection will point out that the fan designer layed out the wheel blade's entrance and leaving angles very precisely to assure shock-free entrance and a discharge such as would yield the desired performance. When the flow through the wheel is disturbed by any means, unintentional or otherwise, the effective blade angles are changed and the resultant performance is likewise changed just as surely as if the metal blades of the wheel had been hammered to new shapes. The inlet condition was corrected by the simple sheet metal alterations shown in Fig. 4.

As a result, normal conditions and characteristics were reestablished. Specified volume was now obtained —an increase of 64%. The pressure increased from 100% to 159% and was accomplished using the original motor.

Fan static air horsepower output is proportional to the product of the volume and static pressure.

By comparison, we have:

| | Volume | Static Pressure | Output Factor |
|---|---|---|---|
| As Installed | 1.00 | 1.00 | 1.00 |
| As Corrected | 1.64 | 1.59 | 2.61 |

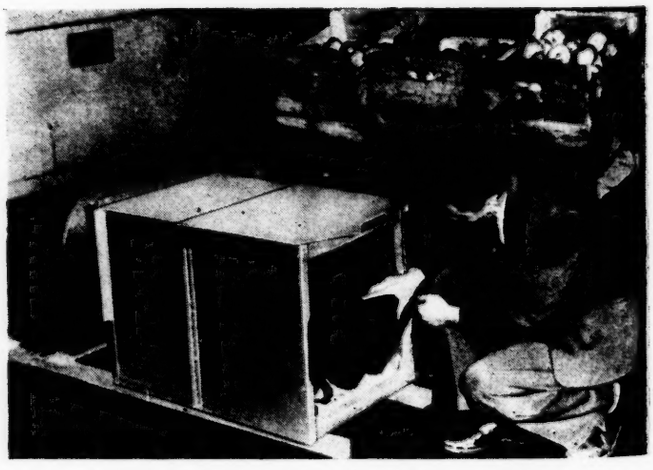
Thus, with *no change of fan details or fan speed,* the ouput was increased 161%. The changes were quickly accomplished. The first cost and installation cost of a much larger motor was avoided.

## Activated Carbon Protects Apples in Storage

Research and field installations in refrigerated apple storage warehouses, conducted under the direction of Professors R. M. Smock and F. W. Southwick of the Cornell University Agricultural Experiment Station, indicates a broad field for activated carbon air purification. Tests have revealed that carbon-purified air lengthened the storage life of apples by at least 25%, and also minimized skin "scald" or discoloration.

It is known that ethylene given off by apples as they ripen accelerates the ripening of other apples in storage. Certain other gases, as yet unidentified, released by apples in storage, will actually burn the skin of certain varieties and result in a "scalded," brown appearance. Vagrant and unwanted odors are sometimes picked up from other stored produce.

Activated carbon has reduced these risks in apple storage by adsorbing gases and vapors. A small blower draws the storage air through the carbon which is suspended in cylindrical, hollow-walled canisters, and a larger blower distributes the purified air throughout the storage room. Present practice is to employ one



Installation of activated carbon canisters.

canister for each 200 bushels of apples. On a five-year basis the total expenditure is said to be less than a cent and a half per bushel, per year. Activated carbon air purification equipment is a product of the W. B. Connor Engineering Corp. of New York.

# Proper Drainage of Oil Separators

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**Installations to provide proper functioning under conditions of alternate pressure and vacuum. Incorrect and also the correct methods are illustrated.**

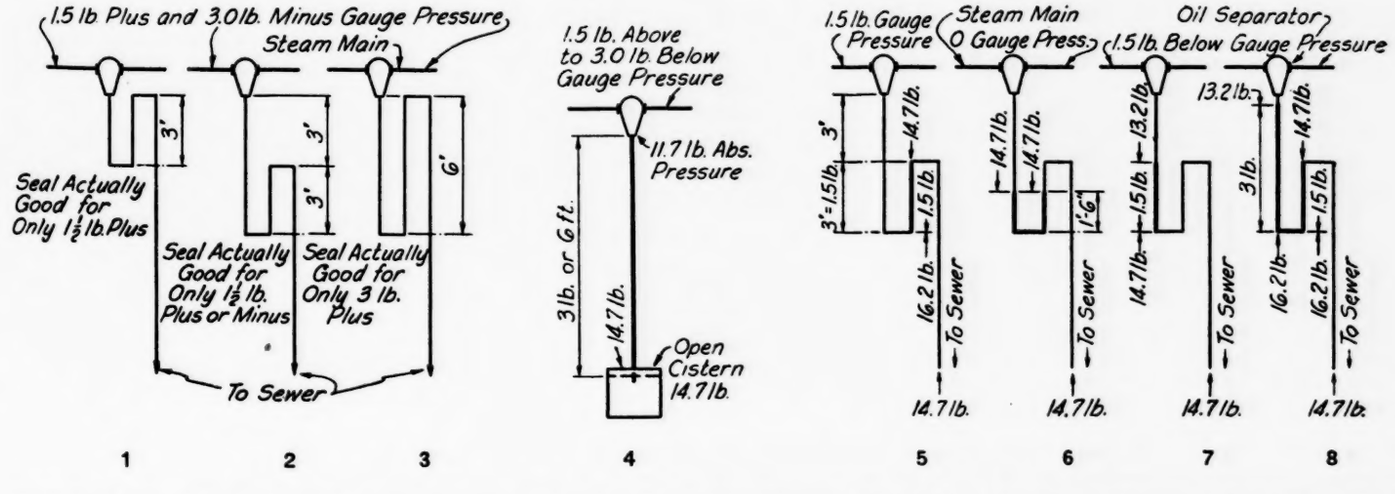
THE question of proper drainage of oil separators is subject to a lot of wrong reasoning. The situation becomes more confused when the drainage must be from a steam main of a vacuum return heating system. During periods of light loads, or when the supply of exhaust steam is less than the demand, the pressure will go below that of the atmosphere. Oil may then be returned to the heating system unless the necessary precautions are taken to obviate this.

Fig. 1 shows the condition of oil drainage under vacuum which the writer set out to remedy in 1914 according to Fig. 2 and 3. These he published as being sufficient (especially Fig. 3) for 1½-lb pressure above atmosphere with Fig. 2 and 3 for 3 lb below atmosphere. Since for convenience and sufficient accuracy we can assume 2 ft of head equal to one pound of pressure, the seals in Fig. 1-3 could be maintained against 1.5 lb plus pressure. As for the leg of 6 ft in Fig. 2 and 3, this was originally reasoned by the writer, and erroneously so, as a sufficient seal against back flow of oil to the separator with a 3 lb minus pressure. Actually, Fig. 3 for vacuum conditions was no better than the original Fig. 1. It was correct only for conditions as shown in Fig. 4; Fig. 2 was good for only 1.5 lb above or below atmosphere, even as pointed out by readers at that time.

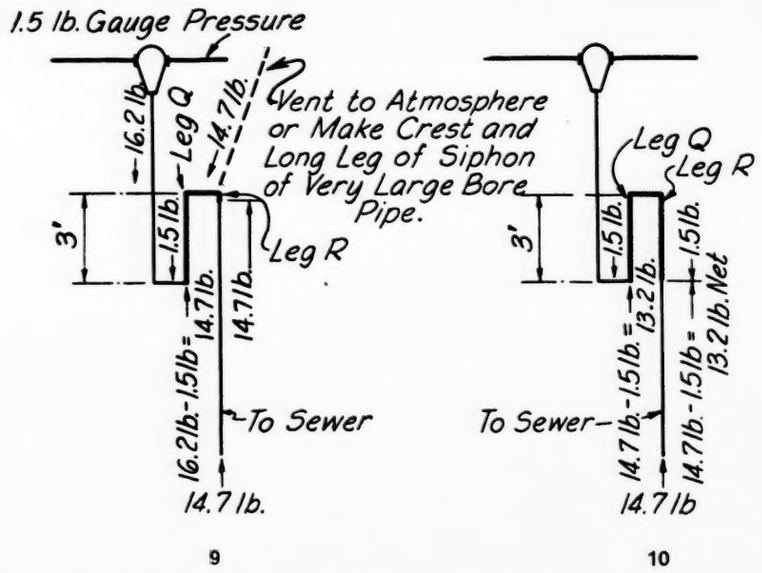
One critic even went so far as to write that while one foot of water head exerted a pressure of 0.434 lb, cylinder oil only gave a pressure of 0.39 lb. This he averaged for the two legs, assuming the right hand leg full of condensate and the other full of oil. How this could happen is a question and why one leg of oil would balance another leg of equal height when full of oil is still another question. So having learned from experience—his and others—that the principle of a siphon (as applied to the drainage of an oil separator under alternate pressure and vacuum conditions) is confusing to more than one person, the writer submits Fig. 5-14 as being helpful, even at the risk of being further corrected.

In Fig. 5-8 inclusive, the steam pressure varies from 1.5 lb gauge pressure to 1.5 lb below gauge pressure. Pressures, however, at the seals are given in terms of absolute pressure. Starting in operation with the steam in the main at a pressure of 1.5 lb gauge, the oil will stand in the right hand leg of the seal as shown in Fig. 5. As the pressure lowers to atmosphere the seal will equalize as in Fig. 6. As the pressure goes to 1.5 lb below atmosphere, the oil will have moved over to the left hand leg of the seal, See Fig. 7. Then, as more oil is received from the oil separator, the oil will fill up the seal and the left hand leg to a point 3 ft above the crest of the siphon as in Fig. 8. Here it remains stationary and any additional oil goes over the crest of the siphon.

Should the oil or condensate be received in sufficient gulps to completely fill the bore of the discharge leg of the siphon, and past a certain point, the entire seal will be siphoned over. This certain point will be at the bottom of the seal, Fig. 10, when the steam main




(Left to right) Fig. 1, 2, and 3. Incorrect methods of draining an oil separator for the given conditions. Fig. 4. Method of draining an oil separator without a siphon. Fig. 5, 6, 7, and 8. Showing action of steam from pressure to vacuum in steam main. Note: All pressures are absolute unless otherwise noted. (2 ft of head equals 1 lb pressure for convenient figuring.)




(Left to right) Fig. 9 and 10. How a non-vented seal will siphon when running full.

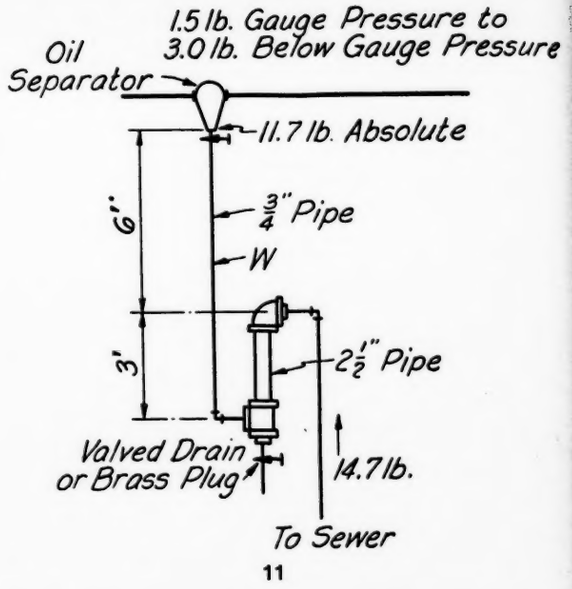
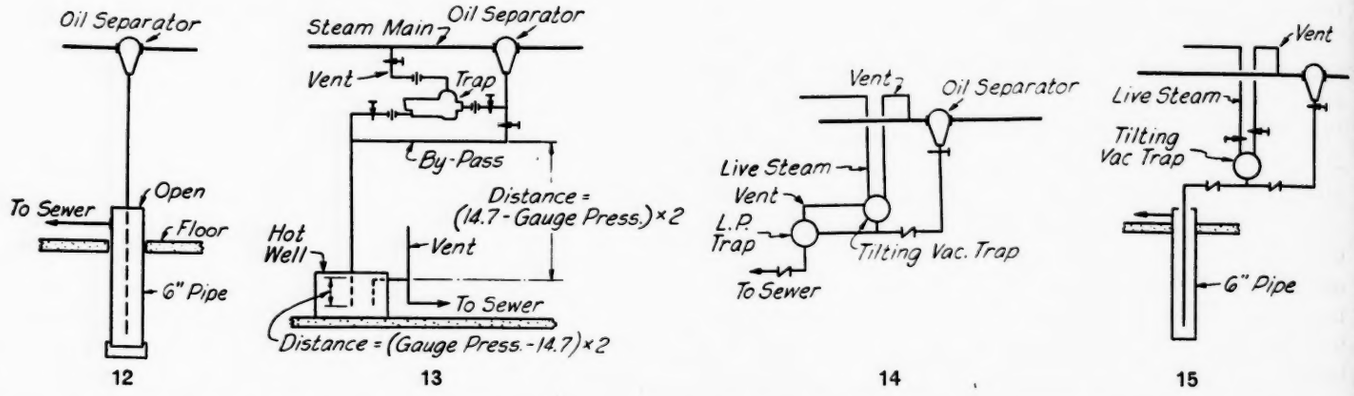



Fig. 11. A reservoir for providing oil to fill pipe W when under vacuum.



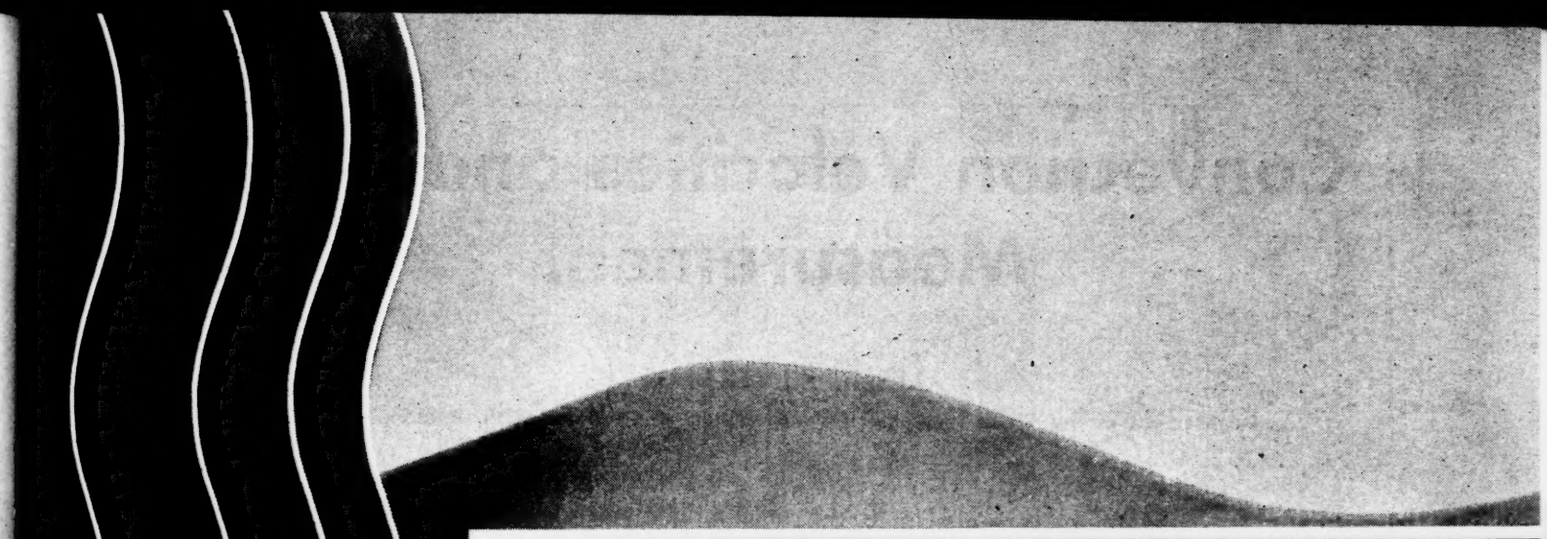

(Left to right) Fig. 12. A siphon for use with limited headroom. Fig. 13, 14, and 15. Various methods of draining oil separators by means of steam traps.

is under 0 lb gauge pressure and at the crest of the siphon, Fig. 9, when the pressure is raised to 1.5 lb gauge. Referring to Fig. 10, the atmospheric pressure tends to force the water up leg *Q* and leg *R*. In each leg this pressure is opposed by an equal pressure of the water or oil in the leg. If leg *R* were longer in depth of liquid within it than that within leg *Q*, the longer column would resist the atmospheric pressure to a greater extent than would the weight of the shorter column. Therefore, the pressure upon the shorter leg is greater than upon the longer and the excess of pressure produces fluid motion and siphonage.

In Fig. 9, where the steam-main pressure is above atmosphere, the discharge leg *R* can be shorter, yet still siphon over the contents of the longer leg *Q* because of an excess of pressure acting on leg *Q* due to leg *R* starting to fill with liquid. Now the way to prevent siphonage is either to vent the crest of the siphon to atmosphere so as to equalize the pressures at top and bottom of *Q* (Fig. 9), or make the long leg on the discharge side of larger bore pipe, so that its volume cannot be filled.

Fig. 11 shows the possibilities where headroom is limited and the drop in pressure below atmosphere is greater at times than the rise in pressure above atmosphere at other times. The seal is deep enough for the pressure rise, but must store enough liquid to furnish the necessary head in the 9 ft leg from the oil separator when under the given vacuum. This is done by making the right hand of the seal of much larger diameter pipe. Fig. 12 is also an arrangement for use where the headroom is limited. It is similar to Fig. 4 except that Fig. 4 cannot be used for steam pressures above atmosphere.

Fig. 13 shows the proper way to drain an oil separator by means of a steam trap for both pressure and vacuum conditions. Fig. 14 and 15 were published by an engineer in 1926. The writer criticised them then for a number of reasons. An additional head of liquid is required to open the check valve, even when 15 degree flaps are used, while the low pressure trap in Fig. 14 appears useless and would be disturbed by the discharge of the other trap. Traps are customarily fitted with by-passes, but their use would make troubles in the cases shown, unless they were kept at the prescribed distance as shown in Fig. 13. Not much would then be saved in headroom. Altogether the arrangements are rather expensive, considering traps, valves and a live steam line which must be insulated.



# CONVECTION VELOCITIES AND THEIR MEASUREMENT

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HEATING AND VENTILATING'S
Reference Section

# Convection Velocities and Their Measurement

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**The laws governing convection currents in both confined and unconfined spaces are formulated and means of velocity measurement described.**

CONVECTION currents are a composite part of almost all phases of ventilation. They represent the driving force in producing natural ventilation in mines, manholes, stacks, chimneys, vents, canopies in industrial ventilation and other applications. They are also a contributing mechanism in the distribution of gases in industrial atmospheres, in atmospheric pollution and in the distribution of hot and cold air for heating and comfort cooling. Convection currents are so much a part of everyday life that many engineers often do not realize their importance.

The purpose of this discussion is to describe several important considerations with regard to convection currents and their measurement, especially as they concern the heating and ventilating engineer.

Broadly, convection currents may be divided into two groups. These groups are based primarily upon the situations in which they occur. In a large number of instances convection currents are confined as in chimneys, draft hoods or enclosed exhaust hoods for heated tanks or vats. Canopies depending upon natural draft for exhausting air in foundries are a good example of the latter situation. Partially confined, unconfined or free convection currents represent the other condition under which these air movements exist. Measurement of the velocity of these currents depends upon the situation in which they exist, and different technics are necessary for each case, as will be shown.

## Convection Currents in Confined Spaces

The laws and relationships for convection currents in confined spaces are fairly well known and readily defined. We know that these currents depend upon the temperature or density difference between two gases or the same gas at different temperatures. The most common occurrence of confined convection currents is in the heating system where direct combustion of fuel takes place. These combustion gases are discharged to the outside atmosphere by means of convection forces. The heating engineer recognizes convection currents in confined spaces by the term "draft". If it is due to atmospheric conditions solely, then it is defined as natural draft. Other types of draft are induced or forced draft. The latter two make use of blowers or fans placed in the system. Induced draft is that provided by fans after the combustion chamber and may eliminate entirely the use of stacks or chimneys, while forced draft is provided to supply air under pressure to the combustion space.

### Chimneys and Stacks

The amount of convective force or natural draft at the base of a stack or chimney (for explanatory purposes this even applies to a column of heated gas or air) is determined by the chimney height, the temperature of the gas within the chimney and the temperature of the ambient air. Wind velocities will sometimes influence the draft from a confined source and they have a marked effect on a partially confined or an unconfined source, as will be shown later. For practical purposes, however, it is not feasible to give consideration to winds in confined stacks or chimneys because they are so variable. The location of the stack above sea level or the effect of altitude will alter the amount of draft or convection current velocity, since it will change the density of the surrounding gas. As the altitude increases the density decreases and correction factors are necessary.

Mathematically then, we may say that the amount of natural convective draft theoretically available is given by the following equation:

$$D_r = 2.96\, B_o H \left[ \frac{W_a}{T_a} - \frac{W_s}{T_s} \right] \qquad (1)$$

where $D_r$ = Draft in inches of water

$B_o$ = Atmospheric pressure in inches of mercury (30 usually taken as normal barometer)

$H$ = Height of stack in feet

$W_a$ = Density of the atmosphere at 0F and sea level pressure, pounds per cubic foot

$W_s$ = Density of stack gas under the same conditions

$T_a$ = Absolute air temperature, F absolute = 460 + $t_a$ ($t_a$ = air temperature, F)

$T_s$ = Absolute gas temperature, F absolute = 460 + $t_s$ ($t_s$ = gas temperature, F)

In order to compute the theoretical velocity corresponding to this draft or convective pressure we use the familiar relationship

$$V = \sqrt{2gh} \qquad (2)$$

here: $V$ = velocity in feet per second

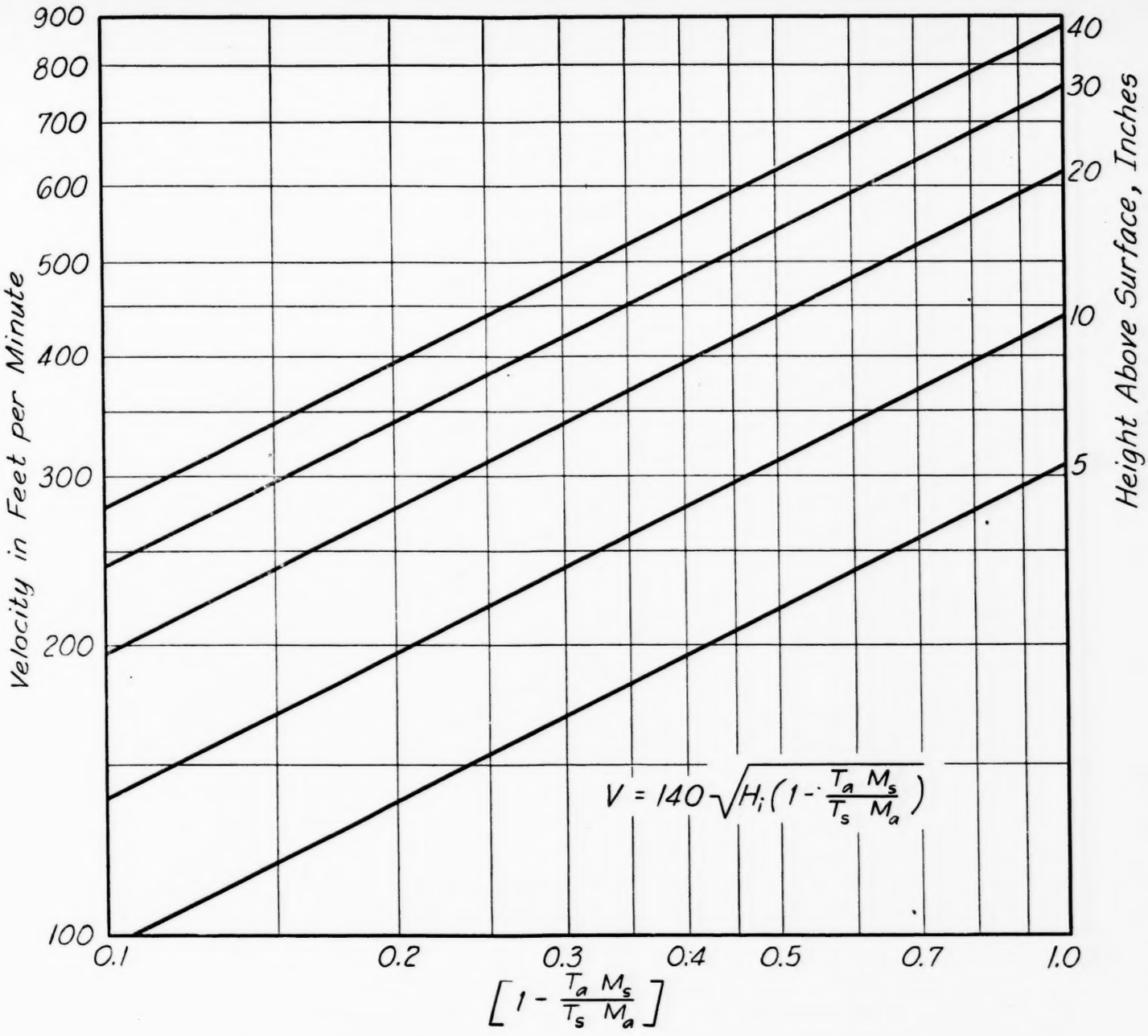


**Fig. 1. Calculation chart for determining theoretical convection velocity.**

$g$ = acceleration of gravity, feet per second per second = 32.2

$h$ = head in feet of air.

In terms of the draft head given above (Equation 1)

$$h = \frac{D_r}{12} \times \frac{W_w}{W_a} \qquad (3)$$

where $W_w$ is the density of water in pounds per cubic foot = 62.4 at 70F (usual temperature of reading gage).

Substituting Equations (3) and (1) in (2) we get

$$V = \sqrt{\frac{2 \times 32.2 \times 62.4 \times 2.96\, B_o H}{12 W_a}\left(\frac{W_a}{T_a} - \frac{W_s}{T_s}\right)} \qquad (4)$$

$V$ in feet per minute is obtained by multiplying Equation (4) by 60 or

$$V_{fpm} = 1890\sqrt{B_o H\left(\frac{1}{T_a} - \frac{W_s}{W_a T_s}\right)} \qquad (5)$$

In order to calculate theoretical velocities at standard conditions substitute t = 0F and $B_o$ = 30 in Equation (5) and obtain

$$V_{fpm} = 484\sqrt{H\left(1 - \frac{W_s}{W_a}\frac{T_a}{T_s}\right)} \qquad (6)$$

Since gas densities are directly proportional to molecular weight $M$ at the same pressure and temperature and $\frac{H_i}{12}$ (inches) = H we can place equation (6) in a form which will permit calculations to be made for unconfined convection currents where chimney or convective columns are of lower magnitude. Using the above relations in (6)

$$V_{fpm} = 140\sqrt{H_i\left(1 - \frac{M_s}{M_a}\frac{T_a}{T_s}\right)} \qquad (7)$$

Equation (7) may be used to predict the maximum possible velocity under theoretical conditions for a

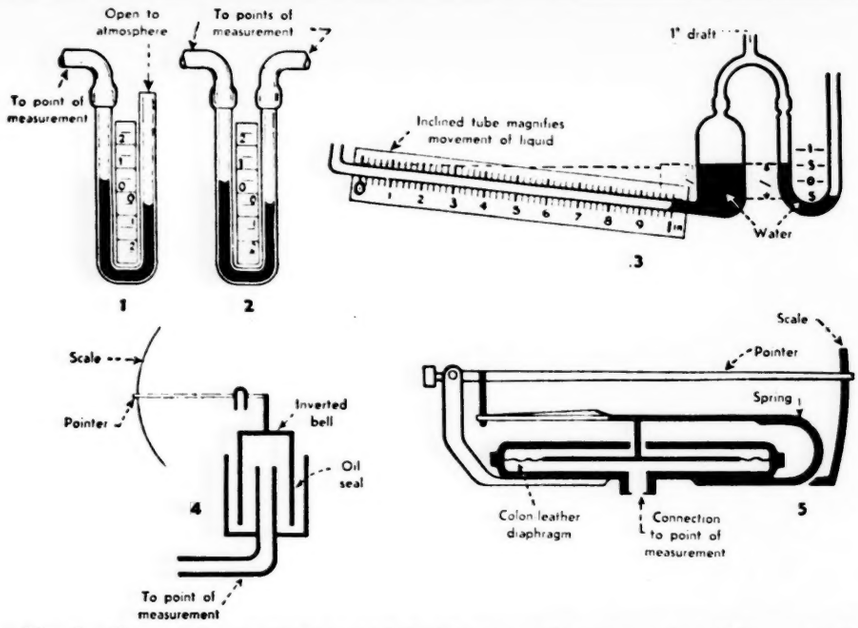


**Fig. 2. Types of manometers and draft gauges for measuring chimney and stack drafts. (From Hays Corp. publication "Draft").**

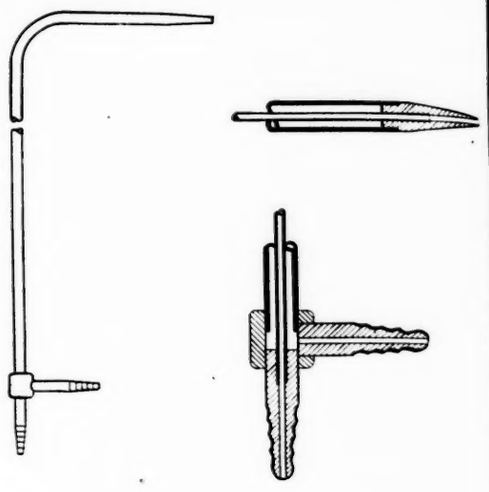

**Fig. 3. Standard Pitot tube used by U. S. Bureau of Mines.**

given instance. For example, what is the maximum velocity that a column of steam will attain in a frictionless chimney at a point 12 inches above a boiling pan or vat in ambient air at 70F, assuming that the steam temperature is 212F at this height. (Because of the high latent heat of steam this is a reasonable assumption.) Substituting in (7)

$$V = 140\sqrt{12\left[1 - \frac{18}{29}\left(\frac{460 + 70}{460 + 212}\right)\right]}$$

$$V = 344 \text{ fpm}$$

Equations (1) and (7) of course assume that no loss has taken place through friction or flow resistance. In the actual case, however, the resistance to flow will reduce the velocity considerably. In the case of confined convection currents this can be evaluated since the resistance loss is subtracted from the theoretical draft. In mathematical form the actual draft in a confined condition is defined by

$$D_r = \text{theoretical draft} - \text{resistance loss} \qquad (8)$$

In terms of actual chimneys or stacks

$$D_r = 2.96\ B_o H\left[\frac{W_a}{T_a} - \frac{W_s}{T_s}\right] - \frac{0.184\ f\ W_s\ B_o H V^2}{T_s\ D} \qquad (9)$$

where in addition to the terms defined in Equation (1) we have

$f$ = friction factor

$D$ = minimum internal diameter of chimney

$$\text{or stack in feet} = 0.288\sqrt{\frac{W\ T_s}{B_o W_s\ V}}$$

where $W$ = weight of gas flowing in pounds per second. Hence, if the friction factor $f$, gas velocity, and density are known, the loss in theoretical draft can be computed from Equation (9). Methods of measuring gas velocity will be discussed later in this paper. For the average chimney $f$ is equal to 0.016. It should be recognized that $f$ depends upon the nature of the chimney surface as well as the viscosity and temperature of the discharging gas. The value of 0.016 corresponds to chimney gases at 500F. If the stack is to discharge gases only slightly above room temperature or at an appreciably lower density than the ambient air, then the second term of the equation should be replaced by a value of friction loss corresponding to the type of stack construction and the gas density involved. If heavy-gauge galvanized iron pipe is employed, such as that used in industrial exhaust systems, then the ordinary friction factor charts can be used with a correction for gas density. Such a value can also be obtained from Equation (10) below

$$\text{Resistance loss} = \frac{L}{CD}\left(\frac{V_{fpm}}{4000}\right)^2 \qquad (10)$$

where resistance loss is in inches of water for air at 70F; for other gases multiply by ratio of

$$\frac{\text{density}}{0.075} = \frac{W_a}{0.075}$$

and $L$ = length of pipe in feet

$D$ = pipe diameter in feet

$V_{fpm}$ = velocity in feet per minute

$C$ = coefficient

= 60 perfectly smooth pipe

= 50 heating and ventilating ducts

= 45 smooth tile ducts, brick

= 40 rough tile ducts, concrete

For other than round pipe the equivalent diameter is computed from the hydraulic radius.

## Mines, Tunnels and Manholes

Another instance where confined convection currents

from natural sources are important is in mine, tunnel, or manhole ventilation. Many small metal mines and several large mines are ventilated solely by natural ventilation. In these cases convection takes place through vertical shafts cut through the ground and denoted as ventilation "raises" or shafts. In natural mine ventilation the convective force is due to the depth and difference in underground and surface temperatures. In most American mines the temperature rise per 100 ft of descent into the ground is about 1F. Conditions of surface temperature are quite variable with seasons and, in some mine localities actual reversal of flow takes place with surface temperature variation. Because of this fact it is customary among mine ventilation engineers to use only the theoretical draft equations such as (1) or (7) to obtain the natural draft. A rough estimate frequently used in mining work is that the natural draft is about 0.03 in. of water for each 10F difference in average temperature for each 100-ft difference in vertical elevation under standard air conditions (air density = 0.075). In deep mines, several hundred feet, this draft becomes considerable and often reaches 3 in. or more in winter.

For more accurate determinations of a given situation, Equation (8) can be used with resistance loss values given by Equation (11)

$$\text{Resistance loss} = \frac{KPLV^2}{5.2\,A} \times \frac{W_a}{0.075} \qquad (11)$$

where K = friction factor

P = Perimeter in feet

A = Area of opening in feet

Other terms as in Equation (10)

Values of $K$ are given in Table 1 for different airway conditions.

### Manholes

Not much is known about manhole ventilation. Manholes in city streets and other locations must be ventilated to prevent accumulation of explosive gas concentrations and to provide a safe working atmosphere if the manhole is entered. Jones of the U. S. Bureau of Mines made several studies on manhole ventilation by natural forces. In these investigations the effect of manhole size, number of holes in the cover, wind velocity and the effect of vertical ducts in combination with cover openings were each studied.

**Table 1 – U. S. Bureau of Mines Schedule of Friction Factors for Mine Airways**

(All shafts slightly obstructed)

| Type of Airway by Average Surface Irregularity | Values of K × $10^{10}$ | | | |
|---|---|---|---|---|
| | Straight Shafts | Curved Shafts | | |
| | | Slightly | Moderately | Highly |
| Smooth-lined | 20 | 30 | 35 | 45 |
| Sedimentary rock (or coal) | 60 | 70 | 75 | 85 |
| Timbered (5 foot centers) | 100 | 110 | 115 | 125 |
| Igneous rock | 150 | 160 | 165 | 175 |

**Table 2 – Number of Air Changes Obtained in a Manhole by Natural Ventilation. Effect of Area of Ventilation Openings in the Cover**

| Area of ventilation openings in cover per 100 cubic feet of manhole volume, Square Inches | Air changes in manhole per day | |
|---|---|---|
| | Range | Mean |
| 1 | 1.5 to 3.0 | 2.2 |
| 2 | 1.8 to 4.5 | 3.2 |
| 3 | 2.5 to 5.5 | 4.0 |
| 4 | 3.0 to 6.5 | 4.8 |
| 5 | 3.5 to 7.0 | 5.3 |
| 6 | 4.0 to 8.0 | 6.0 |
| 8 | 5.0 to 10.0 | 7.5 |
| 10 | 6.0 to 11.5 | 8.8 |
| 12 | 7.0 to 13.0 | 10.0 |
| 14 | 8.5 to 14.5 | 11.5 |
| 16 | 9.5 to 16.0 | 12.3 |

For all practical purposes, the size of manholes is not important in their ventilation. For depths of manholes from 8 to 10 ft the relationship between area of cover openings and resultant air changes due to natural forces is given by Table 2. The area of the holes in the cover in relation to manhole volume is the most important factor in manhole ventilation when no other ventilation system is present. The range of variation in Table 2 is affected by outside temperature and wind changes. Wind changes will be discussed below. The provision of vertical ducts in combination with the cover openings increases the number of air changes in the manhole since these ducts provide passage for the ascending or descending air currents (depending upon temperature differences). When a vertical duct is not provided, the supply or infiltering air convection currents must compete with the discharging air currents and less ventilation will result. For efficient ventilation with a solid or non-ventilated cover, two ventilation ducts must be provided, one that enters near the bottom of the hole and the other near the top. The use of ventilation ducts increases the ventilation (rate of air change in the manhole) several fold and where the expense of mechanical ventilation of the space is impractical, ventilation ducts should be provided. The two ducts or a lower duct and a ventilated cover give adequate performance.

For approximate manhole ventilation calculations if air temperatures and depths are known use Equation (7) and take one-half the computed value as the actual convection velocity.

### Buildings and Related Structures

One of the most important instances of convection currents is in the natural ventilation of industrial buildings and other structures. A large number of buildings are now constructed for ventilation solely by mechanical ventilation or air conditioning systems, however, the majority of structures are designed for natural ventilation or a combination of natural and mechanical ventilation.

In the case of building ventilation by natural forces

the two most important factors are the temperature difference between the inside and outside; and the flow produced by wind. Considering the temperature factors only they are dependent upon:

(1) Heat production in the building.

(2) Vertical distance between inlet and outlet.

(3) The area of the inlets and outlets.

If the heat production is known and the temperature difference to be maintained has been selected, then the amount of air to be moved through the building is given by

$$Z = \text{specific heat} \times \text{density} \times Q(t_a - t_o) \quad (12)$$
$$= 0.24 \times 0.075\ Q\ (t_a - t_o)$$

where $Z$ = Heat production in Btu per minute

$Q$ = Air flow in cfm

$t_a - t_o$ = Temperature difference inside-outside, F.

For a given vertical distance between the openings in the building and a given temperature difference the outlets will exhaust a definite amount of air. The building dimensions and window locations fix the height of the outlets.

The quantity of air flowing through these outlets is given by the following equation:

$$Q = C\ V\ A \quad (13)$$

where

$C$ = coefficient of resistance usually taken as 0.65

$V$ = Velocity in feet per minute

$A$ = Area of opening in square feet.

The velocity in this case is the convection velocity as computed from the temperature difference and distance between inlets and outlets. In the case of buildings one-half of the distance is used in an equation similar to (7) or

$$V = 60 \sqrt{\frac{H\ (t_a - t_o)}{2RT}} \quad (14)$$

where $t_a$ = Inside temperature, F

$t_o$ = Outside temperature, F

$R$ = Resistance of opening $= \dfrac{1}{2g\ A^2\ C^2}$

**Table 3 — Increase in Air Flow Created by Excess in Area of One Opening Over Another**

| Ratio of Inlet to Out'et or Vice Versa | Increase in Air Flow, Per Cent |
|---|---|
| 1.0 | 0 |
| 1.25 | 11.0 |
| 1.5 | 17.7 |
| 2.0 | 27.0 |
| 2.5 | 31.5 |
| 3.0 | 34.0 |
| 3.5 | 36.0 |
| 4.0 | 37.0 |
| 4.5 | 37.5 |
| 5.0 | 37.7 |
| 5.5 | 38.0 |
| 6.0 | 38.0 |

$T$ = Average absolute temperature for inside and outside air. In summer = 550F.

Substituting Equation (14) in (13) and using the value given for $C$ we obtain

$$Q = 9.4\ A \sqrt{H\ (t_a - t_o)} \quad (15)$$

If the condition of the outlets and inlets is not favorable or flow is restricted, then a value of $C = 0.5$ is substituted and the equation constant is reduced to 7.2 from 9.4. By means of Equation (15) it is possible to predict the ventilation rate due to convection from temperature and height measurements, if the area is known. If the area of the inlet exceeds that of the outlet or vice versa then a correction factor must be applied. These correction factors are given in Table 3. For maximum efficiency of natural ventilation the height between these openings should be as great as the building construction will permit.

### Effect of Altitude and Wind

The effect of altitude on confined convection currents is to decrease the density of the ambient medium. This will affect both the theoretical draft and the resistance loss. In the case of chimneys and stacks added height may be necessary to produce the desired velocity or to handle the same weight of air as at sea level conditions increased velocity is necessary. The increased friction loss due to these height and flow increases can be compensated by an increase in chimney diameter. The necessary changes in stack dimensions are given in Table 4.

In mines, the effect of altitude is reversed since descent into the mine causes an increase in density. In computing convection currents this density can be taken into account in using Equation (1).

Wind effects on chimneys and stacks are neglected in practical calculations as mentioned. They are also usually neglected in the case of mines. Deflectors may be used on discharges to take advantage of the suction effect similar to roof ventilators on buildings. Where surface winds are steady and strong, similar deflectors may be added to inlets and outlets to obtain the maximum useful wind pressure, but when used on large openings they become bulky and require large radius turns to increase ventilation efficiency significantly. Bureau of Mines manhole studies indicated that wind velocities from 7.7 to 10 miles per hour increase ventilation rates from 22 to 91% over that due to temperature. Different area openings in the cover were investigated but no consistent effect was observed. On the average the effect of wind in the above range is to increase manhole ventilation about 50%.

Wind effects on building ventilation can be computed from a simple formula, namely

$$Q = E\ A\ V \quad (16)$$

Q,A,V as in Equation (13)

$E$ = effectiveness of openings.

If the inlet openings face the wind, $E = 0.5$ to 0.6; if at an angle to the wind, let $E = 0.25$ to 0.35. In installing inlet openings they should be placed to face

in the direction of the prevailing wind for the particular locality. (Prevailing wind information can be obtained from the U. S. Weather Bureau). Outlet openings should be placed on the side of the building opposite the prevailing wind direction. If placed on the roof they should be located in the low pressure area caused by the wind flow over the structure. Outlets may also be located in a monitor on the lee side or in roof ventilators or stacks exposed to direct wind forces. Several types of roof ventilators are available for obtaining maximum efficiency in air removal by wind movement. In determining wind effects and temperature effects in natural ventilation it should be remembered that wind and temperature are subject to the vagaries of the weather so that only approximate calculations can be made on natural ventilation.

### Partially Confined or Unconfined Convection Currents

The incidence of convection currents in partially confined or unconfined spaces is probably greater than that of confined currents. Even in some of the instances cited above as confined they are really only confined from the overall standpoint. Certainly in mines and buildings, although the general air movement is outward and inward, there are many instances of local convection currents due to high or low temperature sources or extraneous air movement. Probably the most prevalent examples of unconfined convection currents exist in domestic and industrial heating systems. The source of heat supply to radiators or convectors (steam or hot water) or warm air ducts (gravity or forced) exists as a confined convection current, but the actual distribution of heat to the occupied or working space takes place by means of unconfined convection currents. In many instances these currents can be observed by the naked eye as they rise from the heated surface. Because of the change in air's refractive index caused by heat, the layers of heated air are observed rising and being dissipated into the ambient air. The small amount of dust in room air also aids in observing currents from such sources. The Tyndall effect; that is, the reflection of light by the rising dust particles also aids in their detection.

The laws governing partially confined or free convection currents are the same as for confined currents. These currents are dependent upon the temperature or density difference between the rising column and the ambient air or medium, and upon the height of the rising column. The theoretical velocity is then defined as in Equations (1) and (7). The friction loss of the rising current is difficult to evaluate since there is no confined stack or chimney. No friction equation for loss exists as in (8) and (9). The writer made several measurements over a heated surface with air as the heated medium. These measurements indicated that the actual velocities for air varying from 70 to 300F are approximately 45 to 50% of the theoretical velocity as calculated from Equation (7).

By means of this factor the actual velocity over heated surfaces and tanks can be calculated from Equation (7). For simplification in calculating velocities for industrial ventilation purposes Equation (7) has been plotted as shown in Fig. 1. When both gases are air the value of $\frac{M_s}{M_a} = 1$. A practical application of this equation and factor to industrial ventilation is in the welding process. In gas or electric arc welding a very high temperature source exists and convection currents created by this source result in the dissipation of welding fumes which create a nuisance and health problem. Control of these fumes is by local exhaust hoods. These hoods must overcome this convectional velocity and direct the fumes into the exhaust system. The actual temperature at the arc is about 3500C, or 6972F. If welding gases are assumed to have the same composition as air (for practical purposes this is a reasonable assumption), then the theoretical velocity (with an ambient air temperature of 75F) obtained from Equation (7) at a distance of 1 in. above the arc is 130 fpm. The actual velocity is then 65 fpm if a 50% factor is employed. This value compares reasonably well with the actual velocities necessary for welding fume control. Studies completed in our laboratory indicate that for different sized coating welding rods the following air velocities are satisfactory for fume control near the arc:

| Rod Size, in. | Velocity, fpm |
|---|---|
| 5/32 | 50 - 60 |
| 1/4 | 80 - 120 |

For a 5/32-in. rod good agreement exists between the control velocity and the calculated convectional velocity. Since the size of the arc is greater with larger rods, a larger convection height should be assumed in calculating the convectional velocity. If 2 in. is assumed in the above calculations the actual velocity becomes 81 fpm.

When convection currents are unconfined they are decelerated as they rise by the resistance of the rising gas column with the ambient air. This friction factor has been found, as shown above, to be about one-half the theoretical for air against air. Other gases may require a different factor. As the gas rises it also

**Table 4 — Altitude Correction Factors for Chimneys and Stacks**

| Altitude, Feet | Barometer, In. Hg. | Necessary Increase* | |
|---|---|---|---|
| | | Stack Height | Stack Diameter |
| 0 | 30.00 | 1.000 | 1.000 |
| 1000 | 28.88 | 1.079 | 1.015 |
| 2000 | 27.80 | 1.164 | 1.030 |
| 3000 | 26.76 | 1.257 | 1.047 |
| 4000 | 25.76 | 1.356 | 1.063 |
| 5000 | 24.79 | 1.464 | 1.079 |
| 6000 | 23.87 | 1.580 | 1.096 |
| 7000 | 22.97 | 1.706 | 1.113 |
| 8000 | 22.11 | 1.841 | 1.130 |
| 9000 | 21.28 | 1.988 | 1.147 |
| 10000 | 20.49 | 2.144 | 1.165 |

*Multiply sea level calculations value by these ratios.

entrains the surrounding air and the amount of this entrainment depends upon the area of the heated surface. This entrainment amounts to approximately 20 to 70% of the primary air volume per foot of travel vertically, and the angle of divergence is approximately 20 degrees. The proper design of canopy hoods for industrial vats and tanks must take this entrainment into consideration. The divergence of the rising steam due to entrainment is accounted for by designing the canopy with a large overhang. The air to be exhausted should equal that created by convection and entrainment.

## Convection Currents in Atmospheric Pollution

Convection currents play an important part in the control and abatement of atmospheric pollution. One of the most practical means of preventing local contamination from the discharge of a noxious or polluting agent is to convey it to the top of a high stack or chimney. Conveyance through the stack is by convection currents or forced draft. Dissemination into the air is dependent upon the wind and turbulent mixing of the gas or polluted air with the surrounding atmosphere. In the case of atmospheric pollution by dusts, smokes, and flyash, the stack is constructed high enough so that the particulate matter will be carried several miles before settling in a greatly reduced concentration. Gases discharged into the air must mix and diffuse into the ambient air until diluted below a perceptible level. In both these situations it is then desirable to have as much mixing of the discharging stream as possible. The convection which causes the hot gas to rise above the stack thus entrains ambient air as it rises and dilutes the gas. The wind effect becomes quite significant because it promotes mixing by a process of eddy diffusion. Since currents or wind in the atmosphere constitute air in turbulent motion, the amount of this turbulence becomes very important; hence, investigators, in studying air pollution, have attempted to measure the degree of air turbulence. Instruments for this purpose will be described.

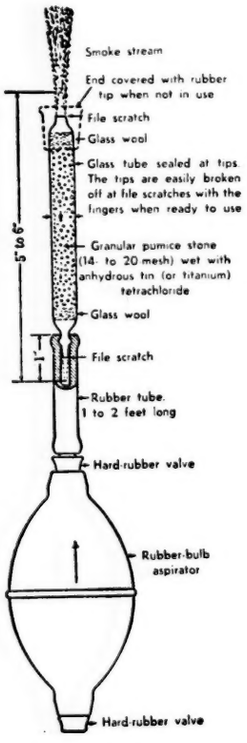
Smoke stream
End covered with rubber tip when not in use
File scratch
Glass wool
Glass tube sealed at tips. The tips are easily broken off at file scratches with the fingers when ready to use
5" to 6"
Granular pumice stone (14- to 20-mesh) wet with anhydrous tin (or titanium) tetrachloride
Glass wool
1"
File scratch
Rubber tube, 1 to 2 feet long
Hard-rubber valve
Rubber-bulb aspirator
Hard-rubber valve

**Fig. 4. Smoke tube for determining air current directions.**

Another example of unconfined convection currents are those occurring in rooms because of the occupants. The heat loss from the human body takes place by radiation, convection, and evaporation. Under normal conditions (no sweating) the convective heat loss from the body is approximately 25% of the total heat production. The loss by convection is expressed by

$$\text{Convective heat loss} = AK_c\ (t_s - t_a)\ \sqrt{V} \qquad (17)$$

Where $A$ = body surface area in square feet
$= 0.66\ \text{Weight}_{\text{lbs}}^{0.425} \times \text{Height}_{\text{ft}}^{0.725}$

$K_c$ = Convective heat coefficient in Btu per sq ft per hr per F may be varied in value to account for velocity varying as V directly or as $\sqrt{V}$ given above.

$V$ = Velocity in feet per minute.

$t_s$ = Average surface temperature of exposed skin and clothing, F.

$t_a$ = Air temperature, F.

If the air velocity adjacent to the individual and $K_c$ are known, then the convective heat loss can be calculated from Equation (17). Values of $K_c$ may be obtained for different conditions from publications of the John B. Pierce Laboratory at Yale University. Since the clothing temperature is usually above that of ambient air, convection currents are created adjacent to the clothing surface. Professor Yaglou has presented data on twenty-two sedentary men indicating that for winter conditions, if the ambient air and wall temperature is 72F, the weighted mean clothing surface temperature is 83.0F. Under summer conditions, if the air and wall temperature is 80F the mean clothing surface temperature is 88.8F. For any given convection height, the theoretical convective velocity may be estimated from Equation (7) or Fig. 1. It should be borne in mind, however, that these currents are rapidly dissipated into the ambient air by drafts and extraneous air currents because they are not confined and hence only attain but a fraction of the calculated velocity.

Calculations of convection currents from steam or hot water radiators may also be estimated in a similar manner but are subject to the same limitations.

## Measurement of Convection Currents

The measurement of convection currents in air may be classified as qualitative and quantitative. In the first instance only direction and sense are measured, whereas in the second actual magnitudes are determined. The actual measurement depends upon whether or not the current is confined.

Confined convection currents such as those occurring in stacks, chimneys, draft hoods, and similar situations are usually measured by means of draft gauges or manometers. Fig. 2 shows a series of such gauges. In No. 1, an open U-tube manometer is shown as employed to measure draft at the base of a stack or at a discharge orifice. In No. 2, the same type of gauge is shown as used for differential measures when two points are tapped. When an orifice or Venturi is placed in the line, two point measurements, one upstream of the orifice, the other downstream, are necessary. The inclined gauge shown at No. 3 in Fig. 2 is the customary type of gauge that comes to mind when one thinks of draft gauges. Ordinary drafts are usually 1 to 2 in. of water or less and greater sensitivity is obtained by inclining the gauge. The gauges shown in No. 4 and 5 are of the type used in remote control recording. They do not require as much maintenance and are not affected appreciably by dust and evaporation. For measuring draft, manometers are usually

filled with gauge oil (specific gravity 0.7 to 0.8) and the scale is calibrated to read in inches of water.

If the draft stack and ambient air temperatures are measured, the average velocity may be calculated from Equation (9). The density or composition of the stack gas must also be known (if other than air) and the nature of the stack or chimney surface is necessary in order to select a friction factor.

Direct measurement of the velocity in the stack or chimney can be accomplished by means of the Pitot tube. Such a tube is shown in Fig. 3. The static pressure tube when used alone will read the draft pressure. The Pitot tube is used in conjunction with manometers of the type shown in Fig. 2 (No. 1, 2, 3). The chief limitation of the Pitot tube is that traverses of equal area must be made for determining average velocity if the discharged quantity is to be calculated. Another limitation is that on velocity. The velocity is determined from the Pitot tube by means of a formula similar to (2).

$$V = 1098 \sqrt{\frac{h_i}{w_a}} \qquad (18)$$

$V$ = Velocity in feet per minute

$h_i$ = Manometer reading in inches of water

$w_a$ = Air density, pounds per cubic foot

If the air temperature is 70F, Equation (18) becomes

$$V = 4000 \sqrt{h_i} \qquad (19)$$

The lowest readings which can be made accurately on an inclined draft gauge is approximately 0.025 in. of water. That is, on a 1 to 10 inclined gauge a reading of 0.25 in. of water is obtained. This corresponds to a velocity of 600 fpm at 70F. For velocities less than this amount other devices must be used or a micromanometer such as the Wahlen gauge, which will read as low as 0.001 in. of water may be employed.

The measurement of convection currents in unconfined instances requires that both qualitative and quantitative indicators be used. The most common direction indicator is smoke, either chemical or that produced by burning tobacco, etc. Small fine threads, candle flames and fine powders are also used for direction indicators. A handy smoke generator is shown in Fig. 4. This device uses tin or titanium tetrachloride which hydrolyzes on contact with the moisture in air forming a dense white smoke. By means of this smoke tube, the direction of convection currents may be ascertained. The degree of turbulence of the air may also be estimated by the rate at which the smoke dissipates and diffuses as it moves with the air current. Quantitative measurements of low air flows can be made by timing the travel of a puff of smoke over a measured distance.

When the convection currents are so low that the initial velocity given the puff of smoke emerging from the tube is significant, another method of preparing smoke is desirable. A simple device known as the "Ventilation Indicator" can be used. This instrument was developed by Professor Fairbanks of Cornell University for studying dairy stable ventilation. The indicator consists of two concentric glass dishes. One

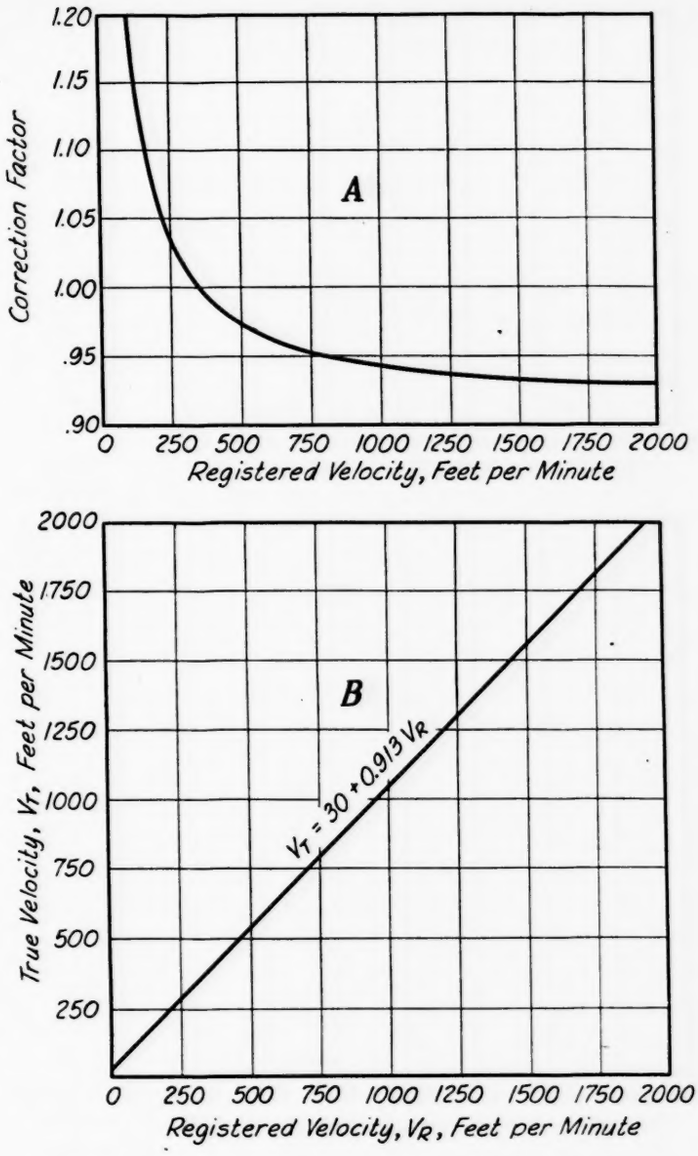


**Fig. 5. Anemometer calibration curves (after McElroy.)**

is filled with concentrated hydrochloric acid and the other with ammonium hydroxide. When these two gases mix in rising they form a cloud of white ammonium chloride fumes which diffuse into the surrounding air indicating current direction and turbulence.

Quantitative measurements of convection currents can be made with mechanical meters such as the vane anemometer or by means of the Velometer which is a swinging vane type meter. The Grillometer, which is a combination of the above two meters may also be used. A simple counterbalanced vane type meter was devised by the writer for measuring ascending currents. (See H & V, Sept., 1942). All of these instruments depend upon density of air and temperature corrections are necessary. If dust is present in the air it should be filtered before measuring. The use of a filter on the Velometer reduces the instrument sensitivity considerably.

The vane anemometer has been widely used in mine ventilation work. If it is kept well oiled and free from dirt and damage it will yield excellent results. The sensitivity of vane anemometers of course varies with

size; some have been made which will record as low as 40 fpm. A significant advantage of the vane anemometer is its ability to record flows accurately even when directions of flow are variable. Variation of angle as much as 20 degrees affect the accuracy less than 2%. Fig. 5 shows typical anemometer calibration curves and correction factors. Another advantage of the vane anemometer, which was observed by the National Bureau of Standards, is that its recording is not appreciably affected by turbulence. The advantage of the Velometer, Grillometer and balanced vane instrument is that a stopwatch and timing are eliminated. All of these instruments are affected by direction, and in use, the velocity direction is determined by reading the maximum velocity when rotating the instrument.

The measurement of non-directional air currents such as those occurring in rooms and buildings are measured by means of heated instruments. These instruments have been made in several forms. The most common of these are the Kata thermometer, the heated thermometer anemometer, the thermocouple anemometer, and the hot-wire anemometer. All of these instruments depend upon the same principle; namely, air velocity is measured indirectly by its effect on heat loss or gain of a given surface. In mathematical form these instruments all approximate the following equation in their performance.

$$\frac{\text{Power, heat loss, or heat input}}{\text{Temperature Difference}} = K_o + K_1 \sqrt{V} \quad (20)$$

where: Temperature difference is that between the heated or cooled surface of the instrument and ambient air

$K_o$ = Still air coefficient (determined in still air where the velocity is equal to that due to convection created by the instrument) $K_o$ depends upon the size and shape of the heated or cooled surface and its emissivity factor since some heat is also lost or gained by radiation to the surroundings in still air.

$K_1$ = Velocity coefficient which depends upon size, shape and surface characteristics of the heated or cooled surface.

The Kata thermometer is the simplest of the heated instruments and consists of a large alcohol thermometer bulb and stem. The bulb is cylindrical with spherical ends and is approximately 1 in. in diameter and 2 in. long. This thermometer is filled with a red alcohol solution and its stem is marked at 95 and 100F. In use, the alcohol bulb is heated in a thermos water bath until the stem is filled with alcohol halfway up in a small well above the 100F mark. The bulb is removed, wiped dry and placed at the point to be measured. The ambient air temperature and the cooling time between 100 and 95F are measured. From a previous calibration, the velocity can be determined from these values. Velocity determinations at higher temperatures are made with the blue Kata which has temperature values from 105 to 110F. Both Katas are designed for measuring room air currents not exceeding 500 fpm. With high velocities, the cooling time becomes so small that measurements are difficult or inaccurate. Another limitation of the Kata is that its large bulb creates a high convective velocity itself, so that velocities less than 50 fpm are appreciably affected. Convection effect can be reduced by using the instrument in a horizontal position. The Kata should only be used for conditions for which it has been calibrated. It is non-directional and gives an integrated reading proportional to the turbulence and air motion of the surrounding air.

The heated thermometer anemometer is a device which eliminates some of the objections to the Kata. It consists of two mercury-in-glass thermometers one of which has a small resistance wire heating coil wound around the bulb. The bulb is heated by means of batteries connected to the thermometer leads. The voltage across the bulb is maintained constant and the temperature difference is read at equilibrium. The voltage and temperature difference are referred to a calibration curve for velocity determination. The velocity range of the instrument is from 6 to 6000 fpm. Its convective effect is minimized by using a small bulb and keeping the heated thermometer temperature approximately 10F above ambient air for velocities under 100 fpm. Radiation effects are reduced by using a glossy white or aluminum paint on the heated bulb. The instrument is also non-directional and records turbulence effects as well as velocities. It should be used under the same conditions as it is calibrated.

The thermocouple anemometer is similar to the heated thermometer except that thermocouples are substituted for the thermometers. The hot-wire anemometer uses a heated platinum wire whose resistance change is measured by means of a Wheatstone Bridge. All heated instruments are non-directional and affected by turbulence, and can be used for measuring turbulence. When the heated surface is made very small the calibration curves flatten out so that high velocities cannot be measured accurately unless the heat input is unlimited. The thermocouple anemometer and hot-wire instruments are generally not used in field use, although the U. S. Department of Agriculture developed a field form of the thermocouple anemometer for refrigerator car measurements.

The heated thermometer anemometer is the preferred instrument for measuring room air and non-directional convection currents.

Measurements of turbulence caused by convection currents and wind in the atmosphere are important in air pollution studies. The bridled cup turbulence integrator measures turbulence by means of a series of vanes mounted on a shaft which rotates on a vertical shaft. The vertical shaft can also oscillate up and down. Both of these movements are translated to horizontal motion along two axes and recorded on a paper surface. After a period of operation a maze diagram, whose outer contours resemble that of an ellipse is obtained. The vertical axis in this elliptical diagram represents the degree of turbulence in one plane and the horizontal axis represents that in the other plane. By means of this data the extent to which the pollution is disseminated may be correlated with wind conditions.

# Air Conditioning in Iran

**Some of the simple but practical means that have been used for many centuries in Iran (Persia) to make life comfortable in that country of hot summers are shown in the photographs on these pages.**

TO lessen the effects of the sun, underground and semi-underground living rooms, Fig. 1, have long been common. To make them still cooler, they sometimes contained pools of running water. Currents of air were often introduced into such a room by means of a lofty ventilating tower, Fig. 2, which would catch the slightest breeze and divert it into an alcove immediately beside the pool. Similar ventilating shafts were built over underground reservoirs of water which were fed by streams conducted through aqueducts, often miles long. These aqueducts were excavated below the surface of the ground, thus preventing loss by evaporation.

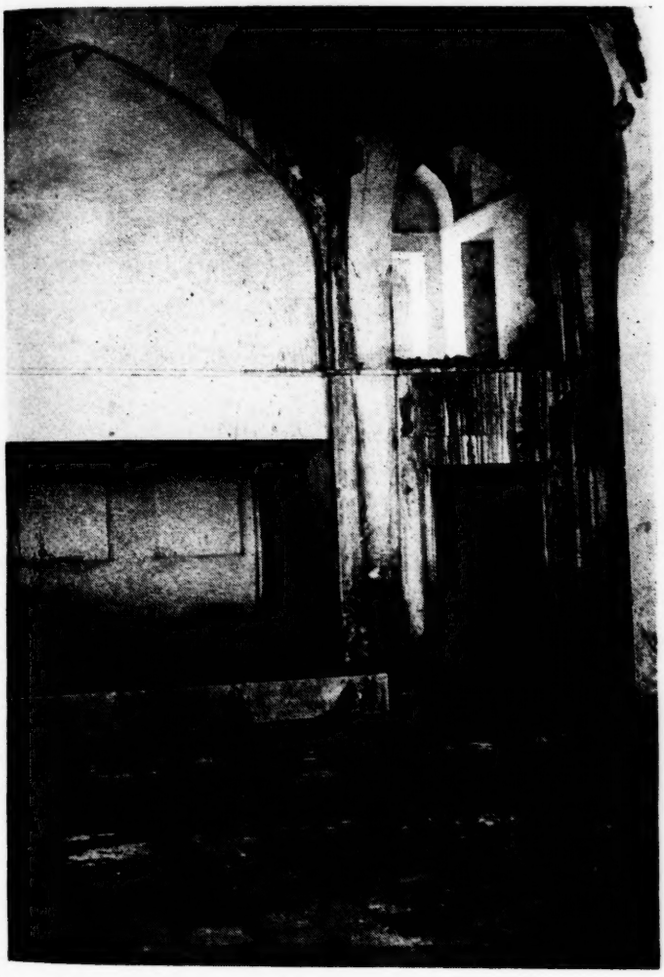

**Fig. 1. A semi-underground chamber (now in disrepair), ventilated by an air shaft, and with a pool of water used for added coolness.**

There are literary references to another scheme for cooling summer quarters practiced a thousand years ago. This consists of building a room with double walls so that ice could be packed between them. While no trace of such construction has been found, the method would not have been impossible, for in Persia, even in places not situated near the mountains, ice has long been obtainable during the summer. It is made and conserved in the following way. A high wall, Fig. 4, is built running from east to west with projecting wings placed at right angles on the north side. Water is run into large shallow depressions in the ground on this side of the wall during the winter months and, when frozen, the ice is raked into deep pits protected by thick domes.

**Fig. 2. Ventilating shafts at Yazd. The horizontal wooden rods are perches for pigeons.**

Another method of keeping a living space cool in the summer was to erect a kiosk over running water.

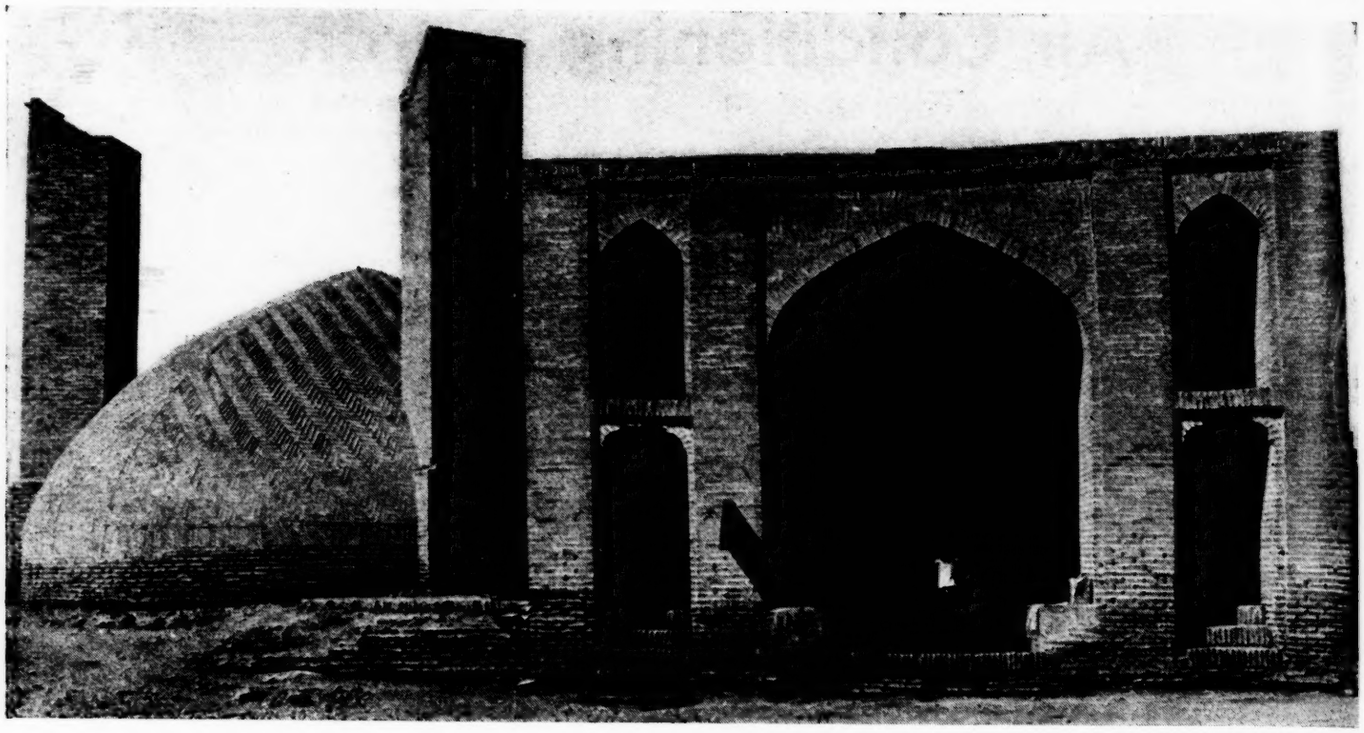

Fig. 3. A ventilated underground reservoir near Yazd. A long flight of brick stairs leads down to the underground reservoir.

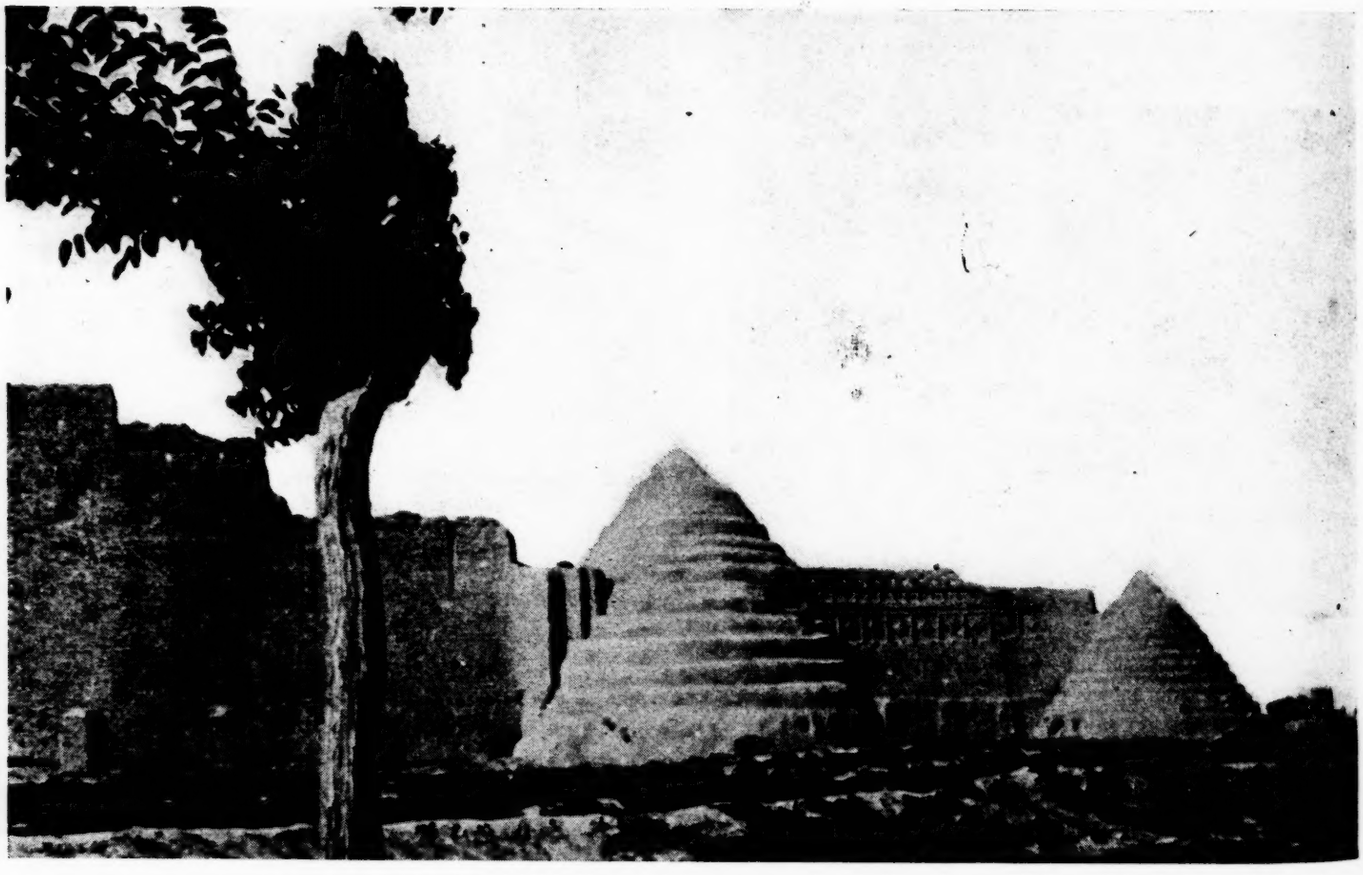

Fig. 4. Decorated ice wall at Saadatabad, Iran. Wall is built high to keep the sun off shallow water pools on the north side. Domed structures are for the storage of ice removed from the pools.

Another way known to have been practiced for many centuries was to cover a tent with felt which was kept wet constantly by running water. Thus the Persians were able to have both cool dwelling places and refreshing drinks in the hot weather by simple but practical devices which they developed by accurate observation of natural phenomena.

Illustrations are from the collection of photographs of the Metropolitan Museum of Art. Captions and text are by C. K. Wilkinson, Senior Research Fellow.

# Heat and Ventilation in the Design of Hog Farrowing Houses

**JAMES L. STRAHAN**

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**This is the third in a series of articles* having to do with the design of animal shelter structures in which control of the environmental factors of temperature and humidity can be maintained by proper operation of a correctly designed ventilating system.**

THERE are several types of structures used by hog raisers but only one of these is of sufficient importance to the enterprise, or costs enough to build, to warrant the application of a carefully considered engineering technique. It is known as the community or centralized hog farrowing house. In plan, it usually consists of two rows or rectangular pens separated by a central feed alley. It has relatively low side walls and ceiling and is generally covered by a low pitched gable or gambrel roof. A feed and cooker room is sometimes included at one end, usually of the same dimensions as one of the pens. Sometimes artificial heat is supplied, but proper insulation, particularly in the less rigorous climates, frequently makes this unnecessary.

It is the aim of the design to utilize insulation so that the natural heat from the animals can maintain a good operating environment inside the building in cold weather, and under most conditions during the normal farrowing season this is possible. At times, however, it may happen that some of the pens will be empty, or farrowing may be timed to come in very cold weather. In either case there will be a deficiency of natural heat, and in order to get proper performance it will be necessary to supply some artificial heat. Heat from the cooker room, if there is one, is usually all that is required. If no cooker room is provided, a small "bucket a day" coal stove will be adequate.

In considering design factors for dairy stables and poultry houses it has been convenient to evaluate them in terms of a single animal or bird. This is not possible in the case of the hog house because this building is occupied by animals of widely differing physical characteristics, heavy brood sows weighing up to 400 pounds and small pigs weighing only three or four. It is better therefore to standardize the biological unit on the basis of the average live weight in a pen, consisting of a sow and her litter. A well managed enterprise should show an average of eight pigs per litter in the farrowing house. This is somewhat better than the general average throughout the country, but should reasonably be expected when good facilities enable the manager to control mortality. This means that each pen, for design purposes, will contain a 400 pound sow and a litter of eight pigs, the latter assumed to be one week old. Animals of these characteristics will produce heat and moisture as shown in the following table.

**Table 1—Heat and Moisture Production of Swine at 68F D.B.**

| Animal | Age or weight | Heat production, Btu per hr | Moisture production, grains per hr |
|---|---|---|---|
| Pig | 1 week | 33 | 60 |
| Pig | 2 weeks | 62 | 105 |
| Gestating Sow | 300 lb. | 771 | 1294 |
| Gestating Sow | 400 lb. | 788 | 1305 |
| Lactating Sow | 400 lb. | 1065 | 1789 |
| Fattening Hog | 200 lb. | 815 | 1369 |
| Fattening Hog | 300 lb. | 1023 | 1719 |

Above data is derived from "Energy Requirements of Swine and Estimates of Heat Production and Gaseous Exchange for Use in Planning the Ventilation of Hog Houses" by H. H. Mitchell and M. A. R. Kelley. Journal of Agricultural Research, 1938.

A 400-pound sow generates more heat after she has farrowed than before. This is incidental to her production of milk for the pigs. However under ordinary conditions (at environmental temperatures between 60 and 70F) about 25% of the heat is in latent form, required to vaporize the moisture she exhales. As in cattle and poultry, this percentage varies widely, from a very small amount at low temperatures to 100% when the temperature of the surrounding air approaches 85 to 90F. At these higher temperatures the hog is usually obliged to resort to outside help in keeping the body temperature down to normal (102F). Hence the hog wallow. At house temperatures of 50F, about 15% of heat will be in latent form. For design purposes, therefore, heat production is assumed to be 85% of the amounts shown in the table.

The amounts of moisture indicated in the tables are produced at a temperature of approximately 68F when 25% of the heat is in latent form. When this percentage is reduced to 15, it is evident that the amount of moisture exhaled will be reduced by 40%, as 15 is 40% less than 25, and it is so assumed.

*Previous articles were "Heat and Ventilation in the Design of Dairy Stables" in the January, 1946, issue and "Heat and Ventilation in the Design of Poultry Houses" in the July, 1946, issue of HEATING AND VENTILATING.

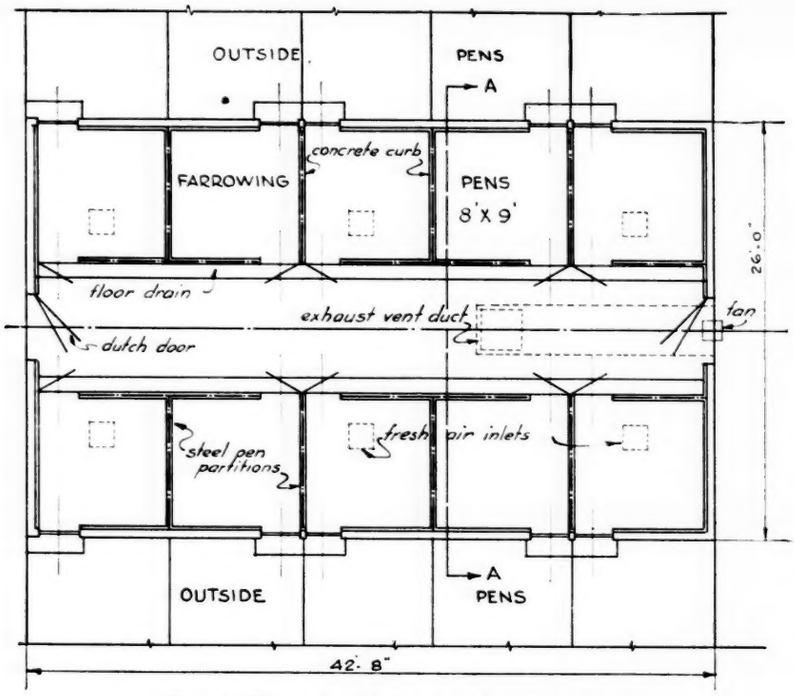


**Fig. 1. Plan of a 10-pen hog farrowing house.**

Table 2 indicates the heat and moisture production per pen in Btu and grains per hour. These values have been used in the design analysis that follows.

**Table 2—Heat and Moisture Production Per Pen in a Farrowing House**

| Animals | Btu per Hr Heat, | Moisture, Grains per Hr |
|---|---|---|
| 400 lb sow | 1065 | 1789 |
| 8 pigs—1 week old | 264 | 480 |
| Total | 1329 | 2269 |
| Minus latent heat—15% | 199 | |
| Available heat | 1130 | |
| Moisture 60% of 2269 | | 1360 |

Fig. 1 and 2 represent a typical layout and sectional design for a 10-pen house. It was designed for the Johns Manville Company by the Better Farm Buildings Association. It can be adapted to a larger enterprise by extending its length, and additional rooms may be added to accommodate facilities for cooking and storing feed. The roof is self-supporting, each rafter section being designed as a scissors truss, which provides for a space between ceiling and roof to serve as a plenum chamber for the ventilating system.

Full thick rock wool batts are placed between studs and lower rafter chords and the inside finish of the ceiling and upper half of the walls consists of 25/32-in. insulated sheathing protected by asbestos cement board, while the lower half of the walls is covered with corrugated asbestos board without the sheathing (See detail Fig. 3). Table 3 is an analysis showing the thermal characteristics of the design.

The weighted average heat loss per square foot per hour (U) will be equal to the total heat loss per hour, 244.3 divided by the total area of exposure, 2451.8, or .0996. In the heat balance formula which follows, this value is designated by the term *C*. In order to evaluate performance and to estimate the range of ventilation requirements, it is necessary first to determine the rate of heat loss per pen. The area of exposure per pen will be 2451.8 divided by 10, or 245.18. This value is designated by the term *A* in the heat balance formula. Heat loss per pen per hour per degree of temperature difference, or $A \times C$, will be $245.18 \times .0996$ or 24.43 Btu.

As in dairy stable and poultry house design, a heat balance formula is used which assumes that all heat produced or available in the building is dissipated by ventilation (or air change) and by conduction and radiation through exposed areas, walls and ceiling or roof. It is stated as follows:

$$H = \frac{VD}{53} + ACD$$

in which

H = heat produced in Btu per animal unit per hour
V = Cfh air change (both infiltration and controlled ventilation)
D = Temperature difference between indoors and outdoors.
A and C as stated above
53 = cubic feet of air raised 1 degree by 1 Btu at design temperature (in this case 50F).

Inasmuch as the object of the design is to enable the operator to maintain a temperature in the building at all times up to the point required by the livestock for most advantageous development or for most efficient biological production, (of milk, eggs, or pork) and to do this regardless of outside temperature fluctuations, it is obvious that ventilation must be restricted in cold weather and increased as outside temperatures moderate. Ventilation heat losses ($\frac{VD}{53}$) must be re-

**Table 3—Analysis of 26 ft. by 42 ft. 8 in. Hog Farrowing House**

| Unit | Area, Sq ft | "U" | "R" | Btu Loss |
|---|---|---|---|---|
| Windows | 40.0 | .45 | 2.22 | 18.00 |
| Doors | 123.2 | .46 | 2.18 | 73.92 |
| Upper wall | 330.0 | .055 | 18.04 | 18.15 |
| Lower wall | 369.6 | .081 | 12.30 | 29.94 |
| Concrete foundation | 35.0 | .36 | 2.80 | 12.60 |
| Ceiling | 1554.0 | .059 | 16.82 | 91.69 |
| Total | 2451.8 | | | 244.30 |

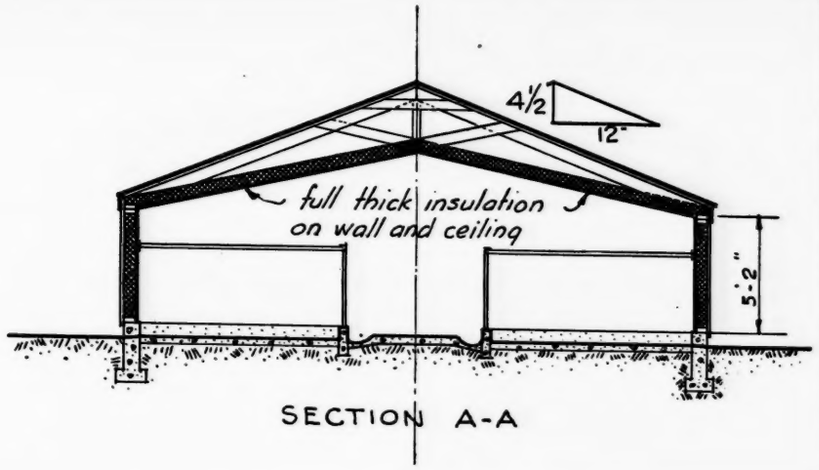


Fig. 2. Section through house insulated on walls and ceiling. A × C = .099.

duced to compensate for increasing conduction losses (ACD). The ventilation design will therefore be based upon the range of ventilation requirements, minimum and maximum volume of air flow in cfh or cfm. A simple algebraic transformation of the heat loss formula which states the value of $V$ in terms of all other factors, can be used for this purpose.

$$V = \frac{53\ [1130 - (24.43 \times 20)]}{20} = 1700 \text{ cfh per pen}$$

Substituting other values for $D$ in increments of 5F

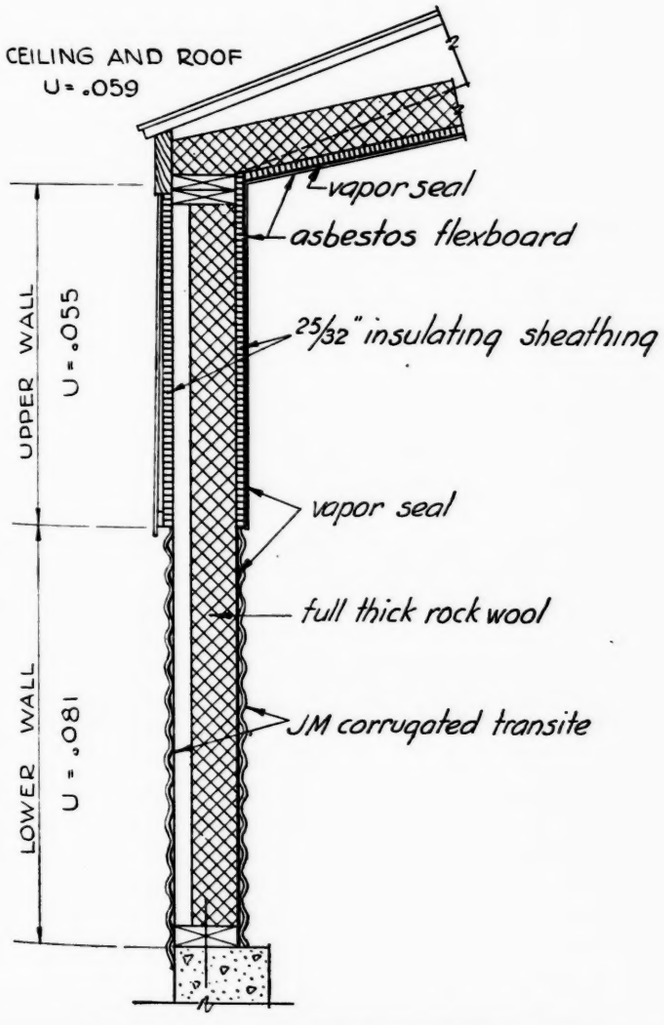


Fig. 3. Details of wall and ceiling insulation.

produced the data for plotting the ventilation curve *A* on the performance chart, Fig. 4. It will be observed that if all ventilation could be cut off (practically impossible, because ventilation here includes infiltration) the maximum temperature difference possible to attain by the use of animal heat alone will be 46½F (inside 50F, outside 3½F).

## Moisture Control

Successful performance in any animal shelter building involves prevention of condensation on interior surfaces. It is therefore necessary to investigate the effect of restriction of ventilation upon relative humidity of inside air in order to determine the critical point at which condensation may be expected to occur on various elements of the structure whose characteristics vary with respect to heat resistance (R). This has been done here on the assumption that inside temperature remains constant at 50F, that the animals produce moisture at the rate indicated in Table 2, and that incoming air is saturated at outside temperatures.

The humidity curve of the pair marked *A* in the performance chart indicates how relative humidity varies as ventilation is restricted when animal heat alone is used to hold the desired inside temperature. At a temperature difference of 20F, when the rate of air change is about 1700 cfh per pen, relative humidity will be 64½%. As outside temperatures fall and ventilation is further restricted, relative humidity takes a slight dip and then increases rapidly until, at an outside temperature of 15F, it reaches the saturation point. Of course condensation will occur on inside surfaces before this point is reached, because inside surface temperatures will be lower than inside air temperature by an amount depending upon the thermal resistance of the construction.

The resistance of the walls and ceiling is high, that of the windows is low. The light diagonal lines are plotted to show the critical relative humidity at which condensation will occur on walls, ceiling, and windows at different outside temperatures. The intersection of these lines with the relative humidity curve *A* indicates outside temperatures at which dampness will show, and therefore indicates the range of satisfactory performance of the design. Condensation can be expected on walls and ceiling at an outside temper-

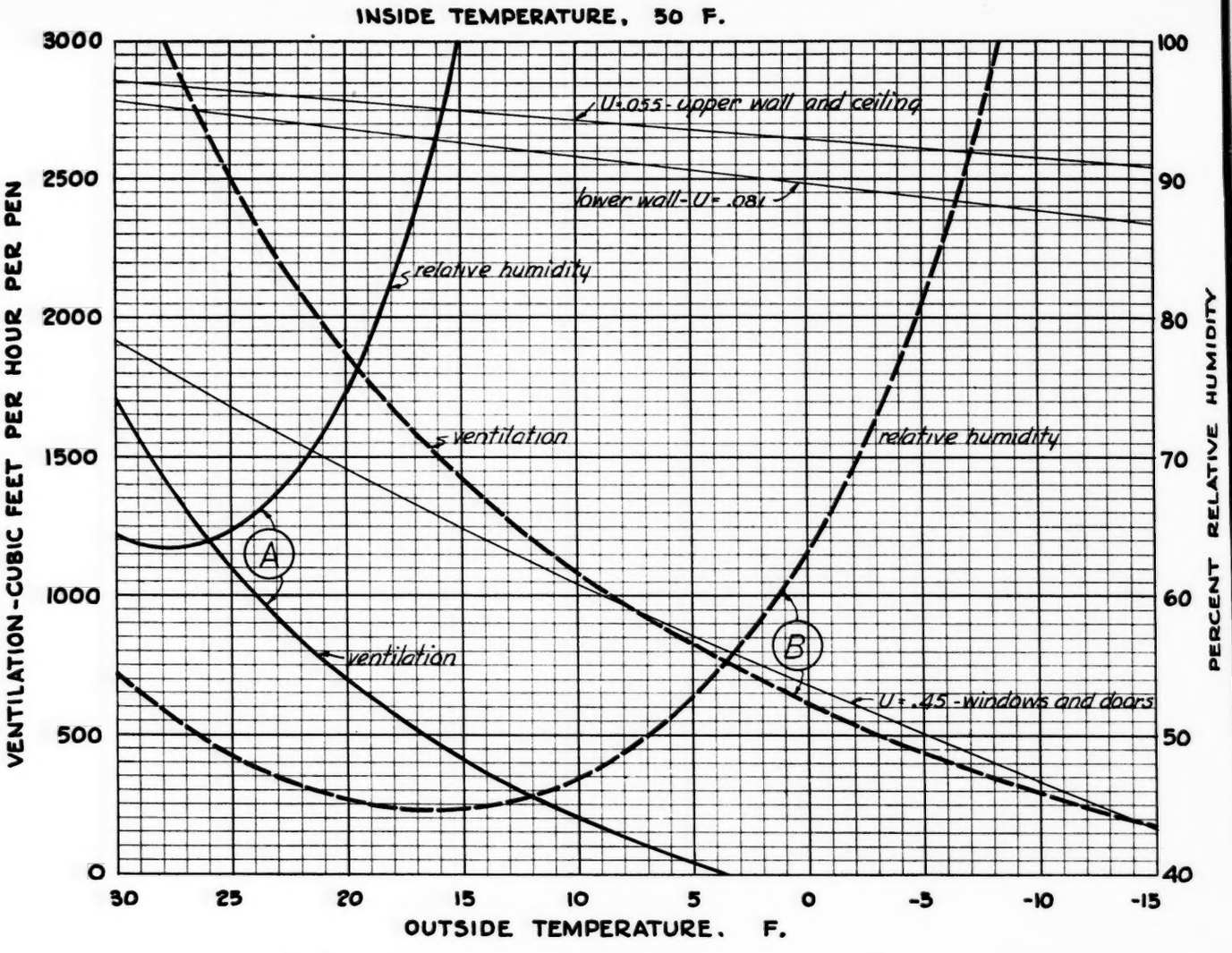


**Fig. 4. Chart indicating performance of design when animal heat alone is used (curves A) and when artificial heat is added, (curves B).**

ature of about 16F while the windows will begin to frost up at about 21½F.

Inasmuch as farrowing, in most cases, occurs in March and April, this performance will be satisfactory in all except the most northerly areas of the country. But earlier farrowing is becoming increasingly popular with many of the larger operators. January and February litters are not uncommon. The analysis given here indicates that a very well insulated house will not perform satisfactorily when temperatures range below 15F. Therefore, to hold the inside temperature up to 50F during the winter months it is necessary to supply some additional artificial heat.

Curves *B* are plotted to indicate performance in this house when sufficient heat is added to supply a total of 1800 Btu per hr per pen. This is an increase of slightly more than 50%, and could be provided by burning 26 lb of coal (12000 Btu per lb) per day in a stove which would yield 50% efficiency. A small "bucket a day" pot-bellied stove is often used.

The ventilation curve indicates a need for more air change at all temperatures than when natural heat alone is being used. Relative humidity does not reach the saturation point until air change is restricted down to 350 cfh per pen at an outside temperature of approximately —8F. The critical relative humidity for walls and ceilings, from 88 to 92%, is reached at —7F and for windows at 3½F. Obviously, the addition of even this small amount of heat has extended the range of usefulness of the house very materially, sufficiently to insure good performance in most areas in the corn hog belt during the winter months.

When operating without artificial heat the fan capacity should be sufficient to produce about two and one half changes of air per hour, about 1700 cfh per pen. It can be restricted down to 500 cfh per pen as the weather becomes colder without danger of condensation on walls and ceiling. But, at an outside temperature of about 18F the addition of artificial heat in the amount indicated will enable the ventilation system, operating at full capacity, to reduce relative humidity from 83% to 45%. From this point, as outside temperatures drop, ventilation can be restricted down to less than 500 cfh per pen without danger of condensation. The low limit is —7F. To still further extend the range of satisfactory performance it will be necessary simply to fire the stove somewhat more vigorously for such short periods of time as may be required. It is obvious that the same ventilating system will be adequate for all situations.

# Legal Status of Independent Contractors

**LEO T. PARKER**
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**Legal distinction between employes and independent contractors. How one can judge when one is an independent contractor. This and three forthcoming articles supplement the reference section, Law of Contracts Simplified, in the April, 1947 issue.**

CONSIDERABLE discussion has arisen from time to time over the legal question: What are legal distinctions between employes and independent contractors?

Few heating contractors are aware of certain well defined laws relating to independent contractors that positively will reduce their chances for liability for injuries to employes. Before explaining the details of this law, probably it is advisable to explain that a heating contractor who employs a person as an *employe*, instead of an independent contractor, is liable for negligent injury of the employe; and also he must pay taxes, in proportion to the wages earned by the employe, for Social Security, United States Unemployment Compensation, State Unemployment Compensation and State Workmen's Compensation for injuries and occupational diseases.

Adding all of these liabilities together, a considerable sum must be paid each year by the heating contractor for each employe. On the other hand, if the person employed is an independent contractor all of these liabilities are immediately and certainly avoided.

### Employe Control Essential for Liability

If a heating contractor has control over an employe, as to how he does his work, instead of how the work or job is *to be completed*, the heating contractor cannot avoid liability under the independent contractor rule. To clearly illustrate this rule of law, we shall review several relevant higher court cases.

First, let us review the leading case of Cushman v. Bernick, 8 N. E. (2d) 446. In this case the court said:

"The vital test in determining whether a person employed to do a certain work is an independent contractor or a mere employe, is the right of control over the work reserved by the employer. If you find from the evidence that defendant did not have the right to control and did not control Fritzgerald's (employe's) actions, then your verdict must be that he was an independent contractor."

In determining whether one acting for a heating contractor is an employe or an independent contractor, the following facts are considered:

(1) The extent of control which, by the agreement, the heating contractor may exercise over the details of the work.

(2) Whether or not the one employed is hired in a distinct occupation or business.

(3) The kind of occupation, with reference to whether the work is usually done under the direction of the employer or by a specialist without supervision.

(4) The skill required in the particular occupation.

(5) Whether the workman supplies the instrumentalities, tools, and the place of work for the person doing the work.

(6) The length of time for which the person is employed.

(7) The method of payment, whether by the time or by the job.

(8) Whether or not the work is a part of the regular business of the employer.

(9) Whether or not the parties believe they are creating the relationship of master and servant.

For illustration, in Boehick Co. v. Industrial Commission, 16 N. W. (2d) 298, it was shown that an owner of a vehicle rented it, with its driver. The owner the vehicle carried the driver on his payroll, paid the driver's unemployment insurance, social security tax, and compensation insurance. The company to which the equipment was rented paid the owner a flat rate of $6.00 per hour and had no control over the driver.

The driver of the vehicle was injured and the question presented the court was: Who is liable for payment of compensation to the injured driver?

The higher court held that the owner of the vehicle is an independent contractor and that he was fully responsible, thereby relieving the company from liability.

### Not Independent Contractor

In the case of Thomas v. Bache, 40 Atl. (2d) 495, decided January, 1945, testimony showed that a contractor named Carter paid an employe named Thomas a stated price per hour to do work and authorized him to have other men assist him, *but Carter paid these employes*. Their time was turned in to Carter by Thomas. Carter paid Thomas an agreed price for each day's work.

In order to illustrate, from the above state of facts, how the courts may differ in opinions here are the facts: The referee in the suit decided that Thomas was an independent contractor. The Compensation Board held that he was a legal employe. The Court of Common Pleas affirmed the Compensation Board and held that Thomas was a legal employe. However, the Superior Court reversed the Court of Common Pleas and held that Thomas was an independent contractor. The case then was appealed to the Superior Court of

Pennsylvania for final decision. This court reversed the Superior Court and held that Thomas was a legal employe. This decision settled the question, and the Supreme Court said:

"The power of an employer to terminate the employment at any time is incompatible with the full control of the work which is usually enjoyed by an independent contractor, and hence is considered as a strong circumstance tending to show the subserviency of the employe . . . "

Thus, the right of an employer to discharge an employe before a job is completed may indicate that such person is a legal employe and not an independent contractor.

Also, see O'Brian v. Michigan Unemployment Compensation Commission, 14 N. W. (2d) 560, where it was shown that a company which sells siding, roofing, heating equipment, etc. employs contractors to perform jobs for property owners. These contractors use their own trucks, tools and equipment. They are not under the control of the company's officials except that the completed job must be done in a good and workmanlike manner. The contractors bear their own loss or profits derived from a particular job, and pay their own employes. However, the testimony showed that the company's officials had *some control over the employes paid by the contractors.* Therefore, the higher court held that these contractors were not legal independent contractors and that the company must pay unemployment compensation taxes to the state on *all money* paid to the contractors.

Also, see the unusual case of Kraemer v. Bates, 11 N. E. (2d) 106, Ohio. The testimony in this case proved that a company made a written contract with a deliveryman. The company agreed to furnish the gasoline and oil, but this cost was charged against the driver who was paid on a percentage basis. The employer furnished day and night repair service for the truck. All expenses incident to greasing, washing, oiling, and gasing the truck, as well as other operating expenses, were paid for by the driver. The driver agrees in the contract to pay for insurance incident to the operation of the truck, including taxes payable for Workmen's Compensation, and to pay all other licenses and taxes including Union fees.

The obvious purpose of this contract was to relieve the company from any and all liability that should arise from operation of the truck. In other words, it was intended that the driver should be an "independent contractor." Undoubtedly up to this point of the contract the driver would have been an independent contractor.

However, another clause in the contract specified that all current notices relating to routing, deliveries, repairs, and operation posted in the office of the employer should be binding upon the driver. Particularly in view of *this clause,* which indicated that the driver was *under control* of the company officials, the higher court held that the relation of employer and employe existed, instead of that of employer and independent contractor.

Thus an independent contractor is one who:

(1) Undertakes to perform work requiring skill.

(2) Is employed to produce certain results according to his own means and methods and to employ his own help.

(3) Agrees to furnish a part or all of the materials or appliances for doing the work.

(4) Is engaged in a distinct and recognized employment.

(5) Is to be paid either a gross sum of money or by piece work.

(6) Is free as to his hours of labor and under no obligation to work exclusively for his employer.

Any one who accepts work under conditions other than these is not an independent contractor.

## Modern Drafting Room

More than one hundred and fifty designing engineers in this recently enlarged Cleveland district drafting room, adjacent to The Austin Company's general offices, have found that the room's new lighting and air-conditioning materially reduce the strain of their work.

Recessed, fluorescent troffer units on 3-ft centers, extending the length of the room between the welded rigid frame arches, have each been equipped with one daylight and one soft-white tube of 40 watt intensity which maintain a lighting intensity of over 90-ft candles on the drafting tables.

Three lines of air-conditioning supply ducts are located on each side of the room toward the outside of the span. A space between the four lines of purlins in the high center section serves as are turn air duct.

Air-conditioning machinery, housed in a small two-story equipment building adjoining the drafting room, includes a fan room designed to handle 35,000 cfm. A new type of electrostatic filter, which applies an electrical charge of between 6,000 and 9,000 volts to filter paper, has been installed on the second floor

across the entrance to the plenum chamber. Reciprocating refrigerating compressors of 100-ton total capacity have been installed on the first floor, with evaporative condensers and other auxiliary equipment. Steam for heating is supplied by the existing boiler plant.

# Experience is my Classroom

By T. W. REYNOLDS

## HIGH WATER LINE

The writer has had two facts made plain to him recently: (1) Keep the water in the steel heating boiler active during the summer as well as in winter; (2) Carry a high water line in the boiler, or else

**You will have to retube the boiler in a much shorter period of time.**

Because the corrosive bubbles which form on the top of the tubes must not be left there all summer and the more active the fire the quicker they are driven off; furthermore, the higher the water line the less there is of bubble formation. The war with its shortage of oil together with a separate coal-fired pot stove (then installed by the writer for hot water supply in the summer) focused attention on this. A boiler water compound should also have been used.

The higher water line also offers an advantage in some boilers due to greatest heat absorption. In any boiler it will also add to the amount of stored hot water, so that when the system goes under vacuum there is more sensible heat to be extracted for the latent heat of evaporation. Steam will then circulate under vacuum throughout the system that much the longer.

Manufacturers do not like to recommend a higher water line, because of the greater tendency of the boiler to carry water over, though it is no doubt a safer method. There is less likelihood of a low water line the higher it is carried.

## REHEAT QUANTITIES

The period requiring the most reheat in summer are the days when the outdoor wet bulb is high and the dry bulb low. If, for example, a job were designed for 76F wet bulb, one should set the worst condition for reheat at a time when the dry bulb temperature was only 2 or 3F higher than the wet bulb temperature. Suppose the outdoor moisture content goes as high as 130 grains per lb or a 75F dewpoint. This corresponds approximately to 80F dry bulb with a 76F wet bulb and would give the worst condition for latent heat gain to the conditioned space and the sensible heat would be very low.

**If the internal heat load from motors, lights and other sources is a big percentage, and is a load that is always present when the building is open, the amount required for reheat would be that due to the missing sensible heat gain and radiant heat gain from the sun. If the installation is one where 100% conditioned air is used at all times, the steam required for reheat would have to be sufficient to make up for any part of the room sensible heat load that is not present on the high humidity low dry bulb days.**

In calculating reheat it is frequently sufficient to assume that the sun gains and building gains are absent at the same time.

## TOILET DUCTS

**A lone toilet room far removed from outside walls or roof quite often presents a problem as to how to avoid long runs of ducts and the use of a separate fan, just for the ventilating of a few toilet fixtures. Generally, however, there are ducts nearby serving other spaces of different nature to which the toilet exhaust duct may be connected if done at a point slightly beyond the last connection served by the main duct. This method lessens the liability of back drafts sending toilet odors into the other spaces whenever the main fan is shut down.**

## BOILER REPAIRS

In the old days, we used bran, flax seed, oatmeal, and even horse manure, to plug a cracked boiler. Then we minded less the odor at air valve exits and accepted the attendant priming of the boiler as a necessary evil. Some even used water glass and sal ammoniac with sulphur to form a rust joint. Today we use X-liquid.

If the crack is a bad one, something is needed to hold the liquid in until such time as it sets. This can be accomplished (where the crack is accessible) by packing it with mineral wool or lead rope and by finishing off with Smooth-On.

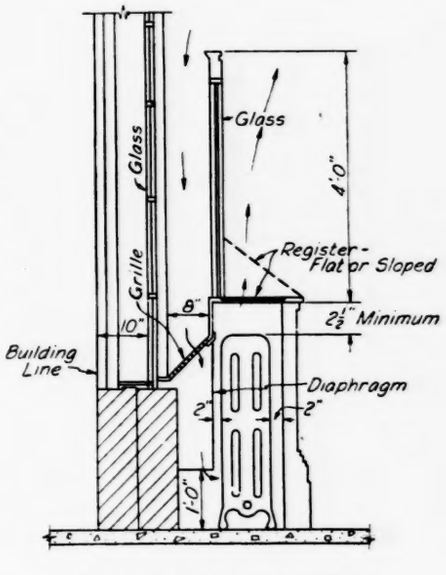
Repairs made in this manner should be left to dry for two or three days. Such repair may be sufficient in itself without the use of X-liquid. If not, then the liquid can be used, say 4 qt. for a very large house, after which the boiler should be operated with a fire for a few days.

If the heating system is hot water, circulation will carry the liquid around and also seal the piping joints. The liquid oxidizes on the outside of a crack in contact with air. It can be left in the system to insure tight joints, but may cause the boiler to prime to a certain extent.

## WHERE DOWNDRAFT IS A PLEASURE

From my data book, an arrangement whereby downdraft from high windows (as in a bank) can be utilized to advantage, is shown in the drawing. The downdraft is kept, but its annoyance is eliminated, while the draft itself serves to increase the heat output of the radiator.

**The register shown provides control of air flow and is often sloped so that books or papers cannot be laid on it. Any papers which might be tossed over the glass shield will be caught by the grille and prevented from accumulating in contact with a hot radiator and such accumulations will be noticed from the outside of the window. Access doors should be provided above the grille at one end of the radiator. A long radiator should have access doors at each end of the radiator enclosure.**




Enclosed radiator detail for high window.

## HOT WATER FOR FREE

The writer one time had a problem in Toronto where a laundry just couldn't get proper draft in the chimney. Since they once had the necessary draft and the chimney was of adequate size, the writer stalled for time to think.

**While on the roof a hot water tank was found. Inquiry obtained the enlightening information that this tank was supplied through a coil in the stack and the date of its installation coincided with the first complaint as to lack of draft. Obviously, the coil in itself offered a resistance to flow of gases and its extraction of heat was so efficient that the temperature of those gases was too low to create the draft desired.**

## GETTING THE AIR OUT

When you finish the air conditioning design, it is a good plan to indicate by arrows the doors which should be louvered, the arrow head indicating the arrangement of the louver, for example, outward from an office or inward to a toilet room. Even when this is done there is no surety that the louvers will be provided; it is just one of those things. You will be told that "the doors are usually open, only closed for, say, ten minutes," or that "the partitions are low," even though low partitions should have means for air to flow in the right direction.

**In any event, have the louvers slant down or up, according to the case. If there is a secretary sitting close outside the door, there may be a complaint as to drafts on the feet in which case the air may be diverted upward. As a rule, there is enough louver area in the bottom panel to pass the return air at low velocity, but check to see if there is only one door from a large area, in which case some other means of air relief must be obtained.**

What goes on in a directors room, conference rooms and some private offices is no concern of anyone in the corridor, so louvers cannot be used in such cases. Relief may be had by openings in the baseboard (See sketches) and these should be soundproofed and without visibility.

## KITCHEN VENTILATION

A kitchen with nothing overhead but the ceiling (no visible hoods, ducts, pipes or fixtures) is a novelty. The writer saw one when it was installed in 1916 at the Hospital for Insane, Whitby, Ontario. Individual vents go down to a duct below the floor. It is all very simple and sanitary. The view is unobstructed and so is the lighting.

Time goes on from there to World War II and a dining room for an industrial plant in New Jersey. Here the conditioned air from the dining room was conserved by discharging it to an office toilet room on the floor below. Trick installations of this kind work well on paper, but not always so in actual operation.

**When the toilet exhaust fan was not working it was possible for toilet air to vent back to the dining room, though this seems never to have happened, at least to the extent of being noticeable. What did happen was that the toilet exhaust fan was often stopped. At such times, kitchen odors by way of the dining room and toilet went out the door from the corridor leading to the toilet and there entered the offices. The office help could usually tell what they would have for dinner.**

The door in question was louvered and was usually open anyway. It seemed impossible to keep that door closed. Another unfortunate part of the installation was the location of the switch in the corridor where anyone could manipulate it to stop the fan, the fan being hung overhead where inadequate bracing made it vibrate out of alignment and become noisy. Of course, the remedy would be to relocate or lock the switch, though this would probably not have been necessary had the fan noise been eliminated. A less simple remedy would have been additional exhaust from the kitchen to prevent odors from travelling to the dining room.

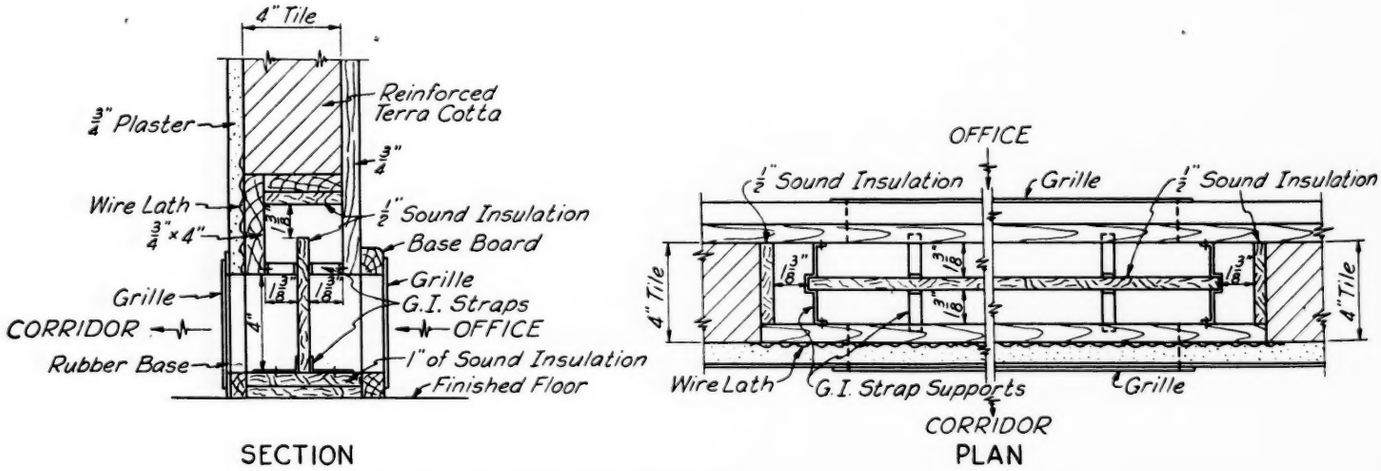
## BOILER TESTING IN SUMMER

A boiler must burn the amount of fuel which would be required during the pick-up period in cold weather and the draft must then be sufficient for the kind of fuel used, amount of fuel fired and depth of fuel bed. If the test is made in warm weather, allowance for additional output with increased winter drafts can be assumed, but if the boiler burns the requisite amount of fuel during the warm weather test, it will certainly do so under the more favorable conditions of lower outside temperature in the winter.

It is well to determine whether the rate of combustion likely to be required continuously for more than a few hours is obtainable and is low enough to prevent clinker trouble. With natural draft, continuous output and a minimum of attention, the following combustion rates as given in pounds per sq ft of grate per hour for various fuels should not be exceeded.

**Buckwheat anthracite, 4; pea size, 5 to 6; nut size and larger anthracite, 8; bituminous with small boilers, caking, 3 to 5 and free-burning 4 to 6, but with large boilers 8 to 10 for either kind of bituminous. The rate for lignite is 4.**

A large firepot is desirable as it secures long intervals between firing in the coldest weather and provides increased radiant heat absorbing surfaces under ordinary firing conditions. Efficiency of combustion is increased by the additional space in which gas and air can mix and burn. The boiler also becomes more adaptable to coke and other light fuels and is better suited to oil burners because of its large combustion volume.




**GETTING THE AIR OUT: Sound and light traps at relief grilles in base boards.**

## WATER FEEDERS

Automatic water feeders were in use for many years before oil burners were sold, it being standard practice to use them as a protection against pump failure where pumps were used, or wherever coal boilers were left for a long time without attention.

**The introduction of oil burners left boilers without attention, hence brought about an increased demand for automatic feeders. When boilers were manually supplied with make-up water, it was customary to start the boilers with a rather high water line. Then, as water evaporated over to take care of the peak demands under pick up load, there would still be left a water line only slightly below normal.**

With the use of automatic water feeders, the operating engineer usually felt that there was nothing for him to do on this matter, since everything was automatic. He would start off with a normal boiler water line, which would be maintained by the automatic feeder regardless of the tendency for this level to drop, then finally the belated condensate would return from the system and flood the boiler. The engineer would immediately drain off this excess water. This, however, is not advisable unless the water is so excessive in amount that it causes carry over due to the elevated water line being too close to the boiler outlets.

Where there are several boilers in a battery under natural draft and the coal used is buckwheat, the pressure and water line in the boilers is apt to vary one from another unless there is proper attention given to the method of uniform firing and thickness of the fuel bed for all boilers. The pump is apt to deliver water to the boiler under lowest pressure and the automatic water feeders will deliver water to any boiler with low water line. The difficulty with the firing of buckwheat is due to the limitations of natural draft. There is too thin a fuel bed and the fire dies out quickly; also thin spots are more apt to develop through which excess air enters to drop the pressure.

**Another important matter of operation is to allow more time for getting the heating system under way. A thin fire will soon get radiant and get up steam quicker, but won't hold it as will a deeper fire. It gives less live coal contact with heat absorbing surfaces, fire doors must be frequently opened for an additional charge of coal, thus allowing cold air to enter and blanketing the radiant fuel bed more often. This method gives less economy, immediately drops pressure, thus making it difficult to keep the steam pressure and water line equal on all boilers, whereas a heavier fire can always be dampered up or down.**

With buckwheat coal the fewer the pounds of coal burned per square foot of grate the less attention the fire requires and the better the pressure is held; hence it is better to have more grate area under fire as obtained by putting more boilers on the line. Buckwheat coal burned at no greater rate than 4½ lb per square foot of grate area will not fuse.

There are various other ways of overcoming difficulties as caused by belated return of condensate or by unequal pressure between boilers in battery. If there is a return pump in the system, it can be regulated so as to operate more frequently, so that the return of water is neither delayed nor sent back in large quantities, but rather is returned at a fairly constant rate. Another method would be to valve off the automatic water feeders for awhile as the pump is first started. Some such means of regulation is particularly desirable where the pump is over size.

**Some difficulties with automatic water feeders have been caused by their off and on operation due to extreme and rapid fluctuations in water line of boilers having dirty water. In such cases the water feeders can be valved off until the water has been sufficiently cleaned.**

## NO ONE'S RESPONSIBILITY

At a New Jersey ferry house the writer had been giving the entire heating system a thorough going over in an effort to cure its many faults. There had been altogether too many complaints of no heat as soon as the writer was off the job, so a few recording pressure gages were installed in strategic spots. Such locations were thought to be secret, but each morning the boiler house engineer liked to tell about a new gage he had located that night. Locks were then put on the gage enclosures, because there was no cooperation between the department that designed and the department that operated.

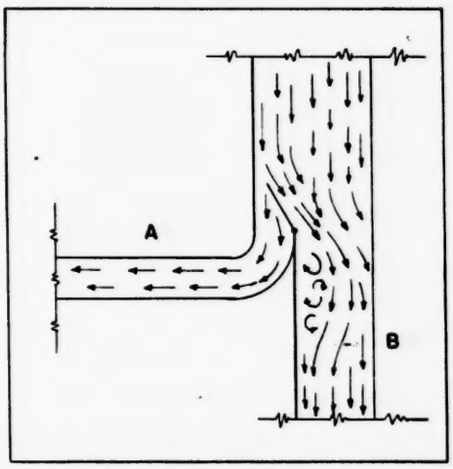
Eventually a call came late at night from Jersey to hurry over, as the whole terminal had no heat. Once there, examination of the recording gages showed no steam pressure at all, while in the boiler house the engineer pointed to the boiler gages indicating full pressure as the end of his responsibility, steam being used for many other purposes than heating.

**Feeling along the main for a cold spot, the writer found it next to a main valve to the ferry buildings, just beyond the boiler house. The valve was closed. Workmen had been working on the line, left in a hurry at closing time, each leaving it for the other one to open. No one person's responsibility.**

## CURIOUS CASE OF DEFLECTING DAMPER

There is no straight line relation between motion and flow increase with a deflection damper. Equal increments of movement of the damper do not give equal incremental changes in flow through the damper. Now this is the cold scientific way of describing a situation which is often accompanied with a warmth of language when one man is reading an anemometer at a grille while his associate is away off down below manipulating the dam-per so as to obtain the desired reading.

**Repeated long distance calling back and forth, the damper is closed more and more while the instrument reads as before. The operator of the damper is urged to close it more, shouts back that it is nearly closed as it is, then closes it some more and the instrument reads zero. This last bit of information duly conveyed to him, he turns the damper back a bit; the instrument then shows too much air and everything is back where it was started.**




**Partial damper closure increases the air flow to the duct it is closing off.**

It is just too difficult a thing to do, to find the place where the damper controls and to stop it on that fine point. To one side of this point there is practically no throttling, to the other side there is substantially no air flow at all. A louver damper with its smaller multi-blades would be a great help on such a situation, giving as it does a throttling action more equal to the damper movement.

A deflection damper has still one other bad operating characteristic. True to its name it deflects the air, but quite often it deflects it the wrong way. If you want less air in branch *A* (See sketch) you open the damper wide for branch *B* so as to partially close off *A*, but curiously enough get more air in *A*. The trouble is, the damper has to be opened so wide that it deflects a certain amount of air to *B*, yet doesn't capture more air for that duct as the turbulence set up therein restricts its area for air passage.

**The final result is that more air flows to the duct which, paradoxically, was dampered down.**

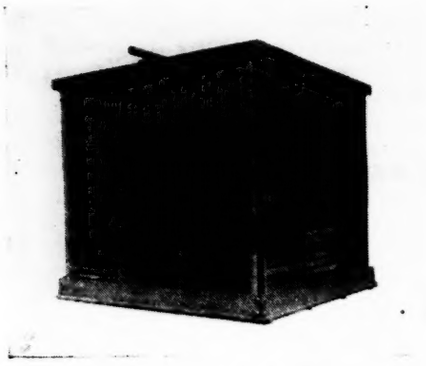
# NEWS OF EQUIPMENT AND MATERIALS

### Cooling Tower

NAME—Series 200—natural draft cooling tower.

PURPOSE—Spray type natural draft cooling tower, which can be expanded in size as the demand increases, for use with open or closed cooling systems.

FEATURES — Tower is designed in standard bays which enables an increase in size, if the cooling



demands increase. It is designed to withstand a 100 mph wind. Unit can be supplied designed to withstand a 112 mph wind, or earthquake design may be obtained. Heavy select heartwood lumber is used throughout with galvanized bolts and special hardware at critical points. Marley spray nozzles are used. Tower is shipped knocked down with every member piece marked, and with complete erection, operation and maintenance instructions supplied.

SIZES AND CAPACITIES—Capacity of 65 to 1,580 gpm.

LITERATURE AVAILABLE — Bulletin 200-47.

MADE BY—*Marley Co., Inc., Kansas City 15, Kans.* ..... 434

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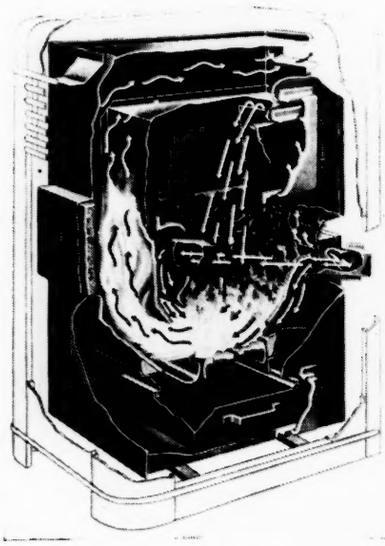
### Smokeless Coal Heater

NAME — Moore smokeless coal heater.

PURPOSE—Cross draft principle of burning coal in a heater to provide smokeless combustion of coal.

FEATURES—Air is brought in at one point only, above the grates. Part of the air moves down through the unburned coal to meet a second



part of the air which has transversed the bed of live coals. These parts of air meet a third portion of air, as shown in the illustration, to improve combustion. Volatile gases and smoke are forced through flame. Makers claim that heater will burn 16 hours on high firing with only one loading and 72 hours on low fire. Research work on this heater was done in collaboration with the Battelle Institute, Columbus, Ohio, and the Bituminous Coal Research Institute, Pittsburgh. Depending upon the size of heater, the coal consumed is from 4 to 10 lb hourly.

SIZES AND CAPACITIES — Three models will be produced.

MADE BY — *Moore Corporation, Joliet, Ill.* ..... 435

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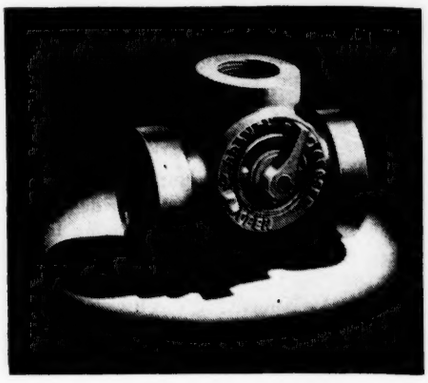
### Adjustable Tee

NAME—Thrush Adjustaflo.

PURPOSE—For controlling temperatures in one pipe forced circulating hot water systems.

FEATURES—One adjustable tee is required for each upfeed radiator. Curved diverter inside unit may be moved to control the amount of hot water diverted from the main to the radiator, thus permitting control of radiator temperature. As the branch flow is cut down, the flow in the main is increased. When the branch is fully closed, there will still be sufficient circulation in the radiator to prevent it from freezing. Diverter can be moved the smallest



fraction of an inch to apportion the amount of water to a radiator.

LITERATURE AVAILABLE—Illustrated folder.

MADE BY—*H. A. Thrush & Co., Peru, Ind.* ..... 436

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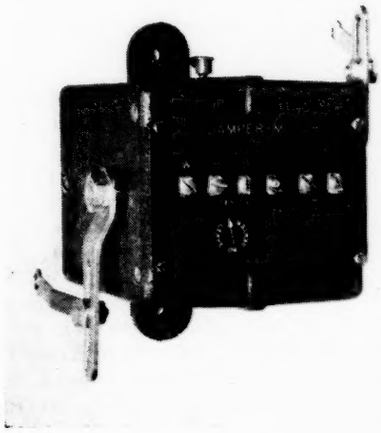
### Damper Motor

NAME—No. 315 damper motor.

PURPOSE — To control draft and check dampers on hand fired heating systems.

FEATURES—Although motor has a three-wire control circuit, a hand switch permits manual operation of the dampers during firing periods.



Unit is mounted on rubber grommets for quiet operation. Motor operates on 20 volts, 50-60 cycles. Maximum load at extreme radius is 20 lb.

MADE BY — *Gleason-Avery, Inc., Auburn, N. Y.* ..... 437

### Flexible Metal Hose

NAME—Penflex.
PURPOSE—A flexible pipe for air, steam, gas, oil and volatiles.
FEATURES — Interlocking wall construction is used in constructing the galvanized steel flexible piping. It also comes in brass and aluminum. Many types of construction are available with this flexible piping.
LITERATURE AVAILABLE — Bulletin No. 90.
SIZES AND CAPACITIES—Up to 30 in. inside diameter.
MADE BY — *Pennsylvania Flexible Metallic Tubing Company, 72nd St. and Powers Lane, Philadelphia 42, Pa.* ..... **438**

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### Railroad Temperature Control

NAME—Minneapolis-Honeywell electronic temperature control.
PURPOSE—Developed for the control of temperatures in railroad passenger cars.

FEATURES—Electronic thermostats installed against the exterior skin of the car feel the slightest variations in weather and react to keep the inside temperature at the comfort level. Heating coils filled with anti-freeze liquid are placed in the side-walls to transform the interior walls to radiant heating panels. In one system where double pane windows are used, heat rises between the panes to prevent chill from the outside. As the outside temperature drops, the car-skin thermostats react to step up the temperature of the heating liquid to counteract the change. These thermostats make the proper adjustments for one side of the car being in the shade and the other bearing the full heat from the sun. With this system, the change from heating to air conditioning is automatic. Sudden blasts of cold air through open doors are controlled by blower fans which operate only when the doors are opened and which are controlled by the electronic thermostats. Used air is disposed through wall slots near the floor. Illustration shows paths of air.
MADE BY—*Minneapolis-Honeywell Regulator Co., 2603 4th Ave. S., Minneapolis, Minn.* ..... **439**

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### Blower

NAME—Bryant Hi-Flo blower.
PURPOSE—Designed for constant pressure output over a broad capacity range.
FEATURES—Unit is constructed with an aluminum housing, bases and side plates, with a light-weight steel impeller. Any one or seven outlet positions may be selected in a simple changeover plan that requires only a wrench for adjusting. Although normally supplied for clockwise rotation entire unit may be reversed without special tools. Maintenance has been minimized. Should impellers become damaged they can easily be replaced. A three-point easy-to-level mounting base simplifies application of these units.

SIZES AND CAPACITIES—Blowers in this series range from 2 to 6 in. in outlet pipe size, supplying 100 to 525 cfm in the 4-oz pressure classification, and in the 2 and 3-in. outlet sizes furnishing 125 cfm at 18 oz and 275 cfm at 16 oz pressure. Motors for blowers range from 1/3 to 2 hp.
LITERATURE AVAILABLE—Data sheets 6A-1 and 6A-2.
MADE BY — *Industrial Division, Bryant Heater Co., 1020 London Rd., Cleveland 10, Ohio.* ..... **440**

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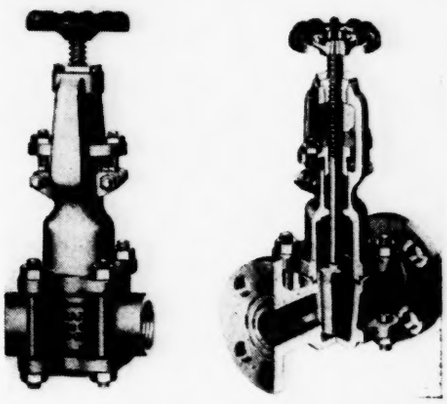
### Plug Gate Valve

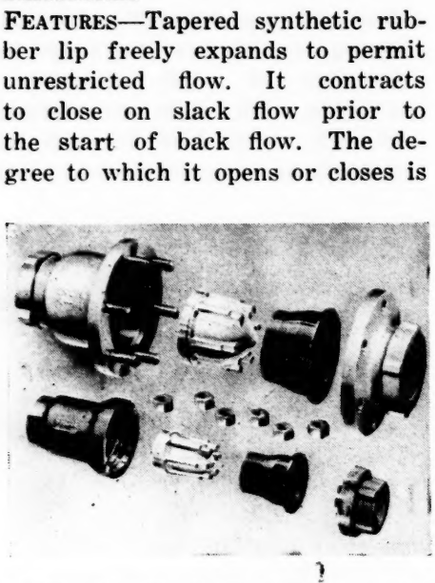
NAME—Crane plug gate valve.
PURPOSE—Corrosion resistant valve with straight-through flow in the wide-open position, yet capable of throttling action.
FEATURES—Valves have bolted bonnet joints and are available with either screwed or flanged ends, in either 18-8 Mo or Monel metal. Valve can be supplied in alloys to the customer's specifications. Design permits close throttling at both high and low velocities. Resistance to cutting action of the fluid when in a throttling position is equal to that of conventional plug type globe valve. Makers claim that it offers very little resistance to flow in the wide open position. It has a maximum discharge equal to that of a wedge gate valve and about twice that of a globe valve.



MADE BY—*Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.* ..... **441**

### Check Valve

NAME—Grove Chexflo valve.
PURPOSE—Simplified form of check valve to operate on low pressure differential.
FEATURES—Tapered synthetic rubber lip freely expands to permit unrestricted flow. It contracts to close on slack flow prior to the start of back flow. The degree to which it opens or closes is



in direct ratio to flow volume. As the valve reaches the shut-off position, flow velocity increases to flush the seating surface of any small particles. Resiliency of flexible tube is said to completely absorb all shock impulses.
MADE BY—*Grove Regulator Co., 65th and Hollis Streets, Oakland, Calif.* ..... **442**

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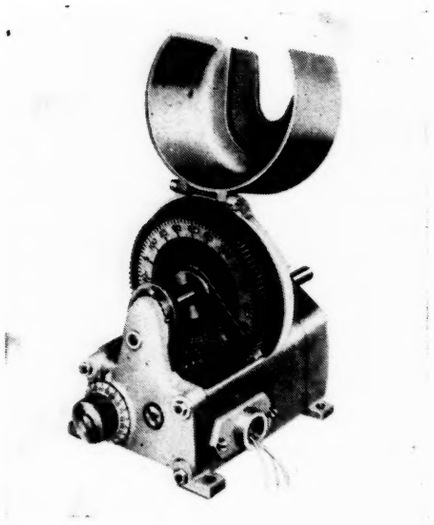
### Process Control

NAME—Cyclo-monitor.
PURPOSE — Automatic electric switching control.
FEATURES — Unit is designed for controlling the operation of signals, lights, drives or motors wherever components are required to function after a predetermined count, measured in strokes or in revolutions. Once the unit is adjusted for a given cycle, each succeeding cycle will be duplicated without further attention. Adjustment is made by setting a pointer and a dial. Each revolution or stroke transmitted to the drive shaft is equivalent to one count on this device. Unit may be adjusted to any number between 1 and 2,000 or any even number between 2,000 and 4,000.



SIZES AND CAPACITIES — Available in two models — one for rotary operation and the other for stroke operation.
MADE BY — *Counter and Control Corp., 2737 S. 28th St., Milwaukee 7, Wis.* ..... **443**

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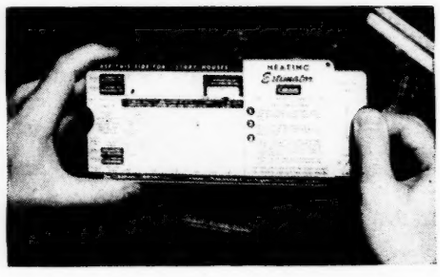
### Heating Estimator

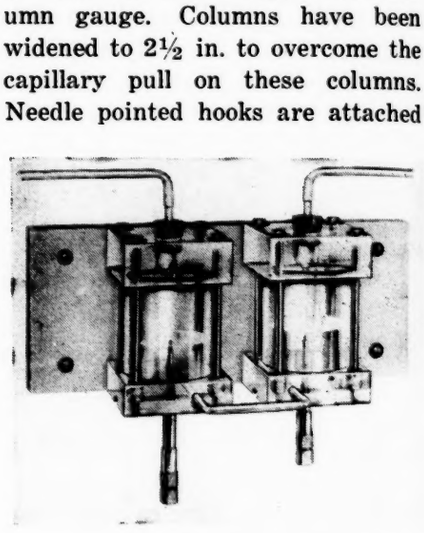
NAME—Coleman heating estimator.
PURPOSE—Calculator to enable quick estimates of building heat loss.
FEATURES—Makers claim that basic data for this mechanical calculating rule was obtained from actual heat loss calculations of more than 2,000



typical small homes. Charts on either side of this rule show factors for 16 of the most common combinations of wall construction, ceiling insulation and storm sash. Charts apply to one and two-story houses. A winter design temperature zone map of the United States is also printed on the rule.
MADE BY — *The Colman Co., Inc., Wichita 1, Kan.* ..... **444**

### Hook Gauge

NAME—Dwyer transparent hook gauge.
PURPOSE—For measuring steady pressures and for calibrating other instruments.
FEATURES—Device operates on the principle of the U-type water column gauge. Columns have been widened to 2½ in. to overcome the capillary pull on these columns. Needle pointed hooks are attached



to depth micrometers and read to one-half of one thousandth of an inch, over a range of 0 to 2 in. The entire gauge, with the exception of hooks and micrometers, is made of an unbreakable, transparent plastic for easy reading.
MADE BY—*F. W. Dwyer Manufacturing Co., 317 S. Western Avenue, Chicago, Ill.* ..... **445**

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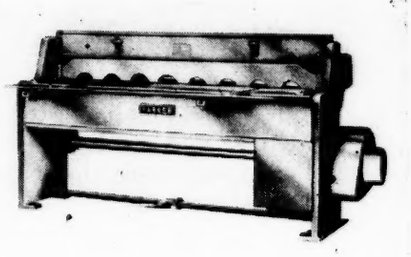
### Power Shears

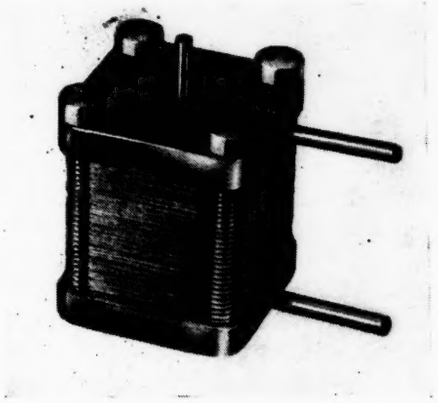
NAME—Parker shears.
PURPOSE—For cutting sheet metal.
FEATURES—Unit is powered by a



5-hp motor which supplies 85 strokes per min. Cutting length 73 in.
MADE BY—*Parker Manufacturing Company, 2200 Colorado Avenue, Santa Monica, Calif.* ..... **446**

### Valve

NAME—Microl valve.
PURPOSE—Precise control of gas or liquid flow through capillary passages.
FEATURES—Valve is constructed by stacking .004 - in. discs between entrance and exit end plates. This provides a tortuous capillary flow running from top to bottom and the length of this path may be varied by raising or lowering the valve stem which in turn cuts off one disc after another. Construction provides a valve characteristic where the resistance is directly proportional to the valve stem motion. Valves are made of nonferrous metal and are said to be able to withstand vibration. Flow of air and other gases may be



varied over the range of 2 cc to 1000 cc with a pressure drop of 15 lb.
MADE BY — *Standard Instruments Co., 15 Elkins St., So. Boston 27, Mass.* ..... **447**

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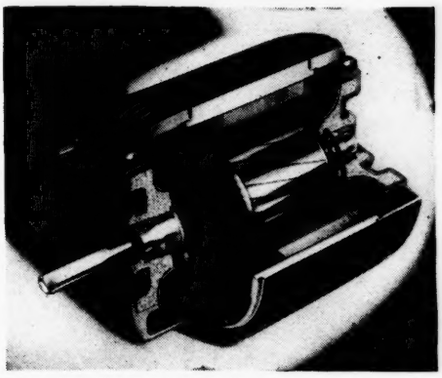
### Small Motor

NAME—Redmond micromotor.
PURPOSE—Fractional horsepower motor designed for continuous fan duty.
FEATURES — One-twentieth horsepower 4-pole shaded pole, a-c motor designed for operation at 1500 rpm. Unit has 2 sq in. of bearing surfaces with individually fitted bearings and 6 cu in. total volume in oil reservoirs. Other features include lubricated silent thrust washers, flush-weld precision skewed rotor, fin line styling with 198 sq in. of



cooling surface and internal air circulation.
MADE BY—*Redmond Co., Inc., Owosso, Mich.* ..... **448**

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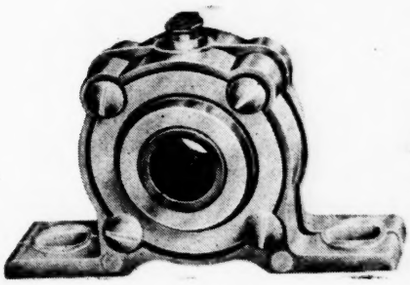
### Block Bearings

NAME—Prentice self-aligning pillow block bearings.
PURPOSE—Support for rotating shafts.
FEATURES—A porous bronze bearing is surrounded by a large, felt oil reservoir to eliminate the need for frequent oiling. Pillow block is said to be self-aligning even though anchored firmly in place.
SIZES AND CAPACITIES—Stock sizes are 5/8, 3/4, 7/8, 1 and 1 3/16 in.



Other sizes from 1/2 to 1 1/8 in. are made to order.
DISTRIBUTED BY—*Western Thermal Equipment Co., 1701 W. Slauson, Los Angeles, Calif.* ..... **449**

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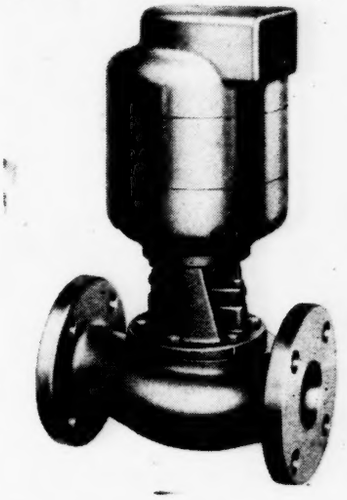
### Circulating Pump

NAME—Rumaco circulating pump —model 1-B.
PURPOSE—For use in hot water heating systems, both domestic and industrial, although it can be used for a number of circulating applications.
FEATURES—Driving motor connected to the pump is totally enclosed with grease packed, sealed precision ball bearings. Motor stator is dynamically balanced by dynetric processes to insure quiet operation. Pump has opposing inlet and outlet for standard 125 lb class 2-inch pipe flanges. Unit can be installed



in any intermediate angle from a vertical to horizontal position.
MADE BY—*The Ruthman Machinery Co., Cincinnati 2, Ohio.* ..... **450**

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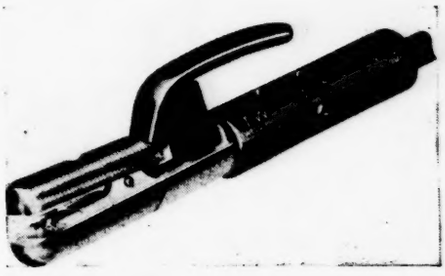
### Electrode Holder

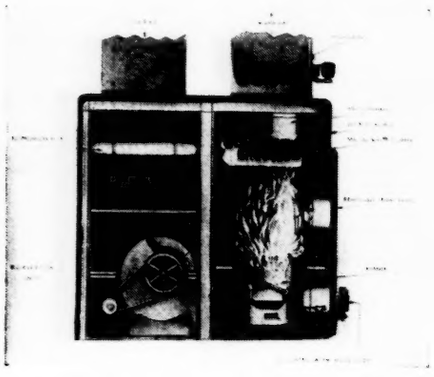
NAME—Twecotong. Model A-316.
PURPOSE—Electrode holder.
FEATURES—Unit is provided with molded glass cloth Bakelite insulation. Insulated spring is neoprene covered. Cable connection is a sim-



ple clamp, plus socket for soldering when desired.
SIZES AND CAPACITIES — Capacity 1/16 through 3/16 in. electrodes.
MADE BY — *Tweco Products Co., Post Office Box 666, Wichita 1, Kans.* ..... **451**

### Warm Air Furnace

NAME—Duo-Therm furnace.
PURPOSE — Furnace design which permits continuous operation of burner so that warm air furnace is always ready to deliver heat.
FEATURES — Furnace is provided with a Duo-Therm burner which is never completely off so that furnace has heat to deliver when called for by the thermostat. Burner's low fire may be adjusted to suit weather conditions. An economizer flue, in some models, serves to pre-



warm cold air entering the furnace. An oversize blower is provided for quiet operation. A constant level oil control is installed to supply uniform metering of oil to the burner. A heat transfer chamber is designed for the quick pick-up of heat from the burner and the transfer of this heat to the house.
SIZES AND CAPACITIES — Eleven models with gravity or blower types, and with manual or thermostatic control. Capacities range from 50,000 to 108,000 Btu.
MADE BY — *Duo-Therm Division, Motor Wheel Corporation, Lansing, Mich.* ..... **452**

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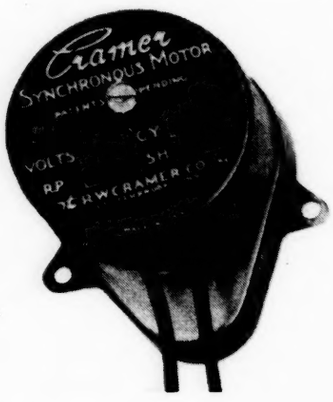
### Motor

NAME—Cramer type SX synchronous motor.
PURPOSE — Fractional horsepower motor for use in the control and instrument fields.
FEATURES—Motors are self starting and run at 240 rpm at 60 cycle. They operate at synchronous speed only. Hunting is prevented and makers claim that overspeed or under speed is impossible. Either




clockwise or counterclockwise motors can be supplied. Company has 28 standard gear trains so that speed from 60 rpm to one revolution in 24 hr can be obtained. Lubricant is sealed within the housing containing the gear train.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*The R. W. Cramer Co., Inc., Centerbrook, Conn.* ..... **453**

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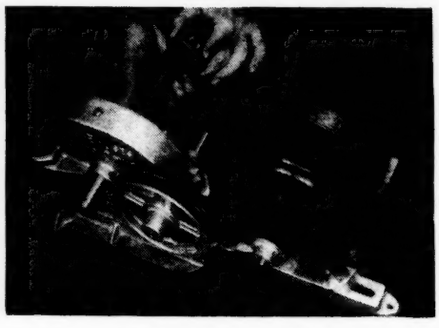
### Power Drive

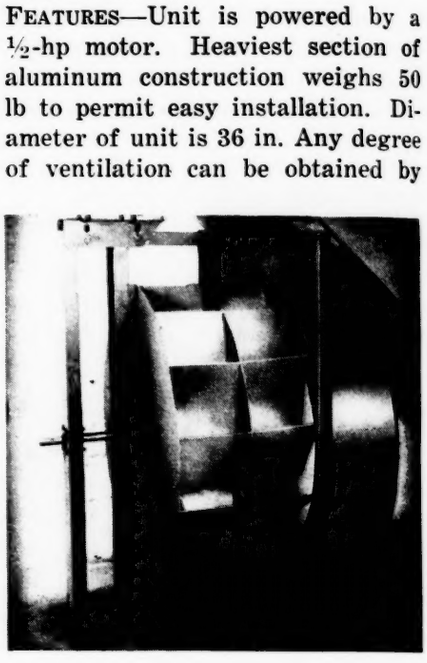
NAME—Men-E-Uses power drive.
PURPOSE—Drive designed for use with fractional horsepower motors.
FEATURES—Drive has a range of from 20 to 750 rpm with 1725 rpm motor. Speeds are obtained by pulley changes. Drive has universal



motor mounting for ½ hp motors and smaller. Base and housing are of aluminum. Unit is supplied with universal coupling and adapter.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*The Flinchbaugh Co., 760 S. Court St., York, Pa.* ..... **454**

### Basement Fan

NAME—Air Changer.
PURPOSE—Cooling houses by drawing in cool night air through basement or attic.
FEATURES—Unit is powered by a ½-hp motor. Heaviest section of aluminum construction weighs 50 lb to permit easy installation. Diameter of unit is 36 in. Any degree of ventilation can be obtained by



adjusting window openings. Although recommended for basement installation, it can be placed in the attic. Paddle wheel blades are acoustically treated to reduce sound.
MADE BY—*Eagle Picher Sales Co., Cincinnati, Ohio.* ..... **455**

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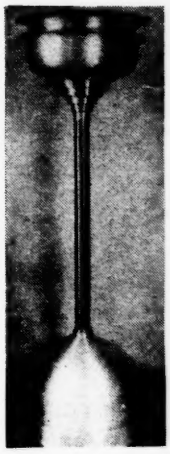
### Rust Prevention

NAME—Elno protector.
PURPOSE — Anodic protection for galvanized steel hot water tanks.
FEATURES—A rod of a special alloy is inserted in galvanized steel hot water tanks, and provides protection for such tanks by corrosive action attacking the rod instead of the tank. Rod is made in ⅞- and 1-in. diameters to fit 1- and ¾-in. tank tappings. Length of rod used is governed by the height of the tank. On request, rods can be supplied in sections to facilitate installations where headroom is limited.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY — *The Cleveland Heater Co., 2310 Superior Ave., Cleveland 14, Ohio.* ..... **456**

### Room Cooler

NAME—Luminaire.
PURPOSE—Combined floor lamp and air conditioning unit.
FEATURES—Compressor, condenser and all controls of air conditioning unit are housed in the aluminum base. Water cooled condenser has ¼ in. fittings at the ends of inlet and outlet hose. Evaporator bowl consists of three bowls, one inside the other with the outside, one of spun aluminum, middle of insulating felt and the inside bowl of spun copper. Evaporator coil of finned copper tubing, three rows wide and three rows deep, sets inside the bowl. Fan motor is mounted to the upper spinning and is 1/50 hp. Cooling capacity of unit is 7,500 Btu per hr or can serve a floor area of 400 sq ft. All refrigerant lines to and from the top of the machine are covered with sponge rubber insulation. Once machine is installed, operation is automatic. In the event of failure of water supply or power, unit will shut itself off and will re-start when the supply returns. Light fixture of unit can be supplied with three fluorescent tubes or two fluorescent tubes and one Sterilamp.



MADE BY—*Parlong Air Conditioning Corporation, 1215 Kenilworth Avenue, N.E., Washington 19, D. C.* ..... **457**

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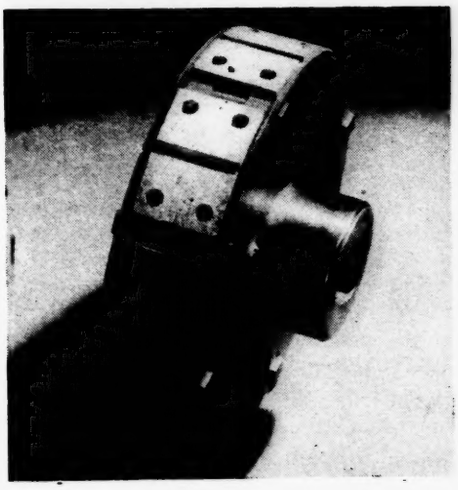
### Clutch

NAME—Mercury clutch.
PURPOSE—Automatic starting of air compressors and similar units.
FEATURES — Clutch permits the driving motor to attain full speed before the compressor turns, thus eliminating the need for pressure release valves. It incorporates a time delay factor which retards the engagement for a second or two so



as to permit the motor to come up to full speed before any load is applied. Starting windings are protected because the motor current is greatly reduced. Mercury is used as the control medium.
OPERATION—Centrifugal force acting on a small amount of mercury produces hydraulic pressure which is dependent upon the head of the mercury rather than the amount. This pressure is utilized without the use of other mechanical means to cause engagement of the friction elements of the clutch.
SIZES AND CAPACITIES—Standard clutches for all types of electric motors up to 15 hp, and for internal combustion engines.
MADE BY—*Mercury Clutch Corp., Canton 6, Ohio.* ..... **458**

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### Aluminum Tubing

NAME — Reynolds aluminum gasline tubing.
PURPOSE — Flexible aluminum tubing for connecting gas appliances to house piping.
FEATURES—Tubing is supplied both in straight lengths and in coils. Tubing should be used with aluminum compression type fittings for connections. Tubing is approved by the AGA and meets the standards of the ASA. It is supplied in 2S-0 and 2S-½H aluminum.
SIZES AND CAPACITIES — Outside diameters from ¼ to 1⅛ in.
MADE BY — *Reynolds Metals Co., 2500 South 3rd Street, Louisville 1, Ky.* ..... **459**

### Pipe Leak Clamp

NAME—Patchmaster.
PURPOSE—To stop leaks in pipes of ½ to 4 in. in diameter.
FEATURES — Clamp consists of a corrosion-resistant stainless steel clamp designed to the pipe contour. When installed and clamp is tightened pressure is brought on plate against the pipe to seal the leak. Makers claim that unit has been tested at 800 lb per sq in. without

leaking. One clamp fits any pipe size up to maximum diameter of clamp.
MADE BY—*Marman Products Co., Inc., 940 W. Redondo Blvd., Inglewood, Calif.* ..... **460**

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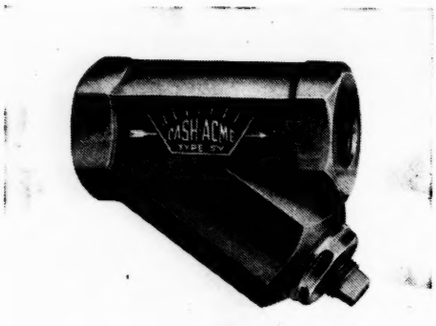
### Mercury Switch

NAME—Con-Tac-Tor mercury switch.
PURPOSE—For general control circuits adaptable to mercury contacts.
FEATURES — Switch measures less than 1½ in. in length and is adaptable to mechanisms that permit a small amount of space for switch-

ing devices. Switch is actuated by a snap tilt of at least 12 deg. Mercury in switch is treated to cause it to move more rapidly.
MADE BY — *Minneapolis-Honeywell Regulator Co., 2747 Fourth Ave., South, Minneapolis 8, Minn.* **461**

### Y Strainer

NAME—Y-type strainer.
PURPOSE—General pipe line strainer use.
FEATURES—Fitting is available in either cadmium plated cast iron or all bronze construction. Strainers




are built around 250 lb standards for cast iron; they are suitable for 400 lb service when furnished with bronze body.
SIZES AND CAPACITIES—From ⅛ in. through and including 2 in.
MADE BY—*A. W. Cash Valve Mfg. Co., Decatur 60, Ill.* ..... **462**

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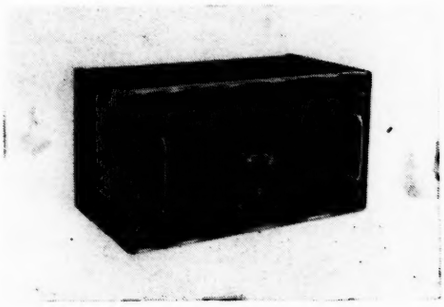
### Voltage Regulator

NAME—Stabiline voltage regulator, type IE.
PURPOSE—Instantaneous correction of line voltage fluctuations with negligible waveform distortion.



FEATURES—Output voltage is said to be held within ± 0.1 volt in the output range between 110 to 120 volts for an input line voltage change from 135 to 95 volts. It is said to be independent of any load power factor change from a lagging 0.5 to a leading 0.9. Instrument operates equally well for any frequency variation up to ± 10% of the designed operating frequency.
MADE BY—*The Superior Electric Company, 559 Laurel St., Bristol, Conn.* ..... **463**

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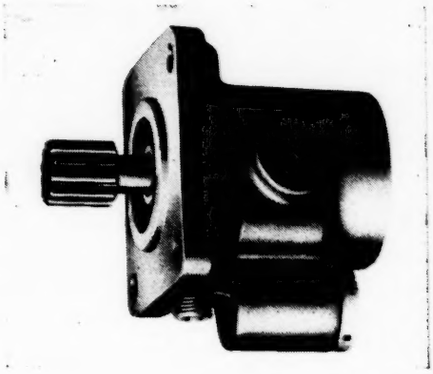
### Aluminum Solder

NAME—Alsoco.
PURPOSE—For soldering aluminum.
FEATURES—Material permits joining aluminum to aluminum without a flux or flux substitute. Solder is said to have high corrosion-resistant qualities.
MADE BY—*Alsoco Corporation, 10 East 52nd Street, New York, N. Y.* ..... **464**

### Fuel Pump

NAME—Model RD-7750 Romec fuel pump.
PURPOSE — Rotary vane pump for handling fuel oil.
FEATURES—Pump is small and light in weight. It is a self-priming, positive displacement unit for handling fuel oil. It is available with



by-pass and relief valves as well as drive couplings for different electric motors. Pump weighs 14 ounces and operates at pressures up to 60 lb per sq in.
MADE BY—*Romec Pump Co., 169 Abbe Rd., Elyria, Ohio.* ..... **465**

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### Electric Water Heater

NAME—Norge electric water heater.
PURPOSE—For producing domestic hot water.
FEATURES—Heating element is a single or double unit provided with thermostats for simple temperature adjustments. A diffusion baffle prevents the mixing of inflowing cold water with that already heated.

SIZES AND CAPACITIES — Available in five sizes with gallonage capacities of 30, 40, 52, 66 and 80. Models are all the round, upright type.
MADE BY — *Norge Division, Borg-Warner Corp., Detroit, Mich.*.... **466**

JUNE, 1947

## TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

**On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 |
| 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 |
| 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 |

**Print your name and address, detach and mail to**
**Editor, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.**

**Name**.....

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**City**.....**Zone**.....**State**.....6/47

# NEWS OF THE MONTH

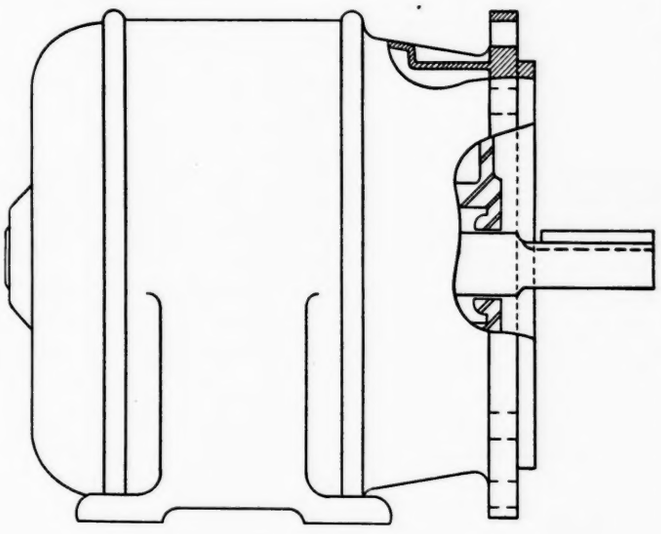
## MOTOR STANDARDS

**are advanced as new "D" flange motor mounting is announced by NEMA.**

Experience over the years with mountings for end-shield mounted electric motors indicated the possibility of developing a single mounting which would serve for both vertical and horizontal shaft end-shield mountings and would be particularly acceptable to the machine tool industry through change from the female rabbet fit characteristic of the "B" flange standard, developed by the National Electrical Manufacturers Association.

• **COMMITTEE.** — To this end a joint committee of representatives from NEMA and the National Machine Tool Builders Association was formed to consider the standardization of motors applied to machine tools. This committee developed a new flange known as the NEMA "D" and established flange dimensions for motors built in frames 203 to 505, which cover ratings from 1 to 125 hp inclusive, at 1750 rpm. Five "D" flanges accommodate the spread of the sixteen different NEMA standardized motor frame sizes.

• **FEATURES.** — This new flange has four principal features, apparent in the illustration, which are marked improvements.



(1) The NEMA "D" flange has a male rabbet.

(2) The face of the NEMA "D" flange is in line with the shaft shoulder.

(3) The diameter of the flange is not greater than the diameter of the motor, except on frames 203 and 204.

(4) The motor mounts on the machine from the motor side. Mounting bouts go through the flange from the motor side.

With this mounting, the only machining necessary on a machine tool or other machine frame, upon which the motor fits, covers an area equal to the diameter of the rabbet. It is not necessary to finish the larger surface needed where a female rabbet fit is used. The exact location of gears, pulleys or couplings can be predetermined regardless of what make motor will eventually be installed and no extra machining is needed to accommodate the larger shaft diameter above the shoulder.

Flanges for smaller motors have four holes for mounting bolts—those for larger motors are provided with eight holes to carry the extra weight. Motors built with NEMA "D" flanges can be had either with or without conventional motor feet. The new standard design can be used in place of three former designs.

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## BUILDING PRODUCT SUBSIDIES

**authorized by Congress are still unused and unwanted, says BPI chairman.**

Douglas Whitlock, chairman of the Building Products Institute, advised Chairman Taber of the House Appropriations Committee that efforts to balance the Federal budget could be expedited by returning to the treasury about $360 million of unexpended funds appropriated last year for subsidies to building product manufacturers.

"Of the $500 million premium payment fund voted by Congress at the insistence of former Housing Expediter Wilson Wyatt and other administration leaders, not more than about $35 million to $40 million will have been spent by June 30 and the balance would serve no useful purpose if it were spent," Mr. Whitlock said.

"Although Mr. Wyatt insisted that the premium payment fund was 'the heart of the veterans housing program' and although the funds were made available by Congress last March over the protests of the building industries, it is significant that less than $10 million of the appropriation had been used by the end of 1946, nine months after the funds were approved.

"Former Expediter Wyatt asked for $600 million, but Congress approved only $400 million, to be spent in the period ending December 31, 1947. Only 10 premium payment plans ever were put into effect and all but four of these already have been terminated without any semblance of protest from industry.

"There is no need whatsoever for offering any additional subsidies to manufacturers of building materials and equipment, just as there was no excuse for the subsidy plan in the first place, and there is no reason for not terminating the fund." Mr. Whitlock declared.

# AIR HYGIENE

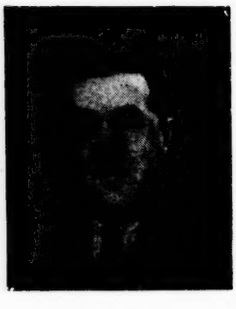
**is favored topic at industrial health meetings in Buffalo.**

Maintenance of worker health control of industrial atmospheres was a predominating subject of discussion at an interlocking series of annual meetings of professional associations concerned with industrial health which took place at the Hotel Statler, Buffalo, N. Y., April 26 through May 4.

• **WHO.**—Meetings were the 32nd annual convention of the American Association of Industrial Physicians and Surgeons; 9th annual meeting of the American Conference of Governmental Industrial Hygienists; 8th annual meeting of the American Industrial Hygiene Association; 5th annual conference of the American Association of Industrial Nurses; and the 4th annual meeting of the American Association of Industrial Dentists. Total registry at the convention for all groups was close to 1,000.

• **AIR CONSCIOUS.** — Most air conscious of these groups, as indicated by scheduled programs, were the industrial hygienists in both governmental and non-governmental organizations. Physicians, too, evidenced awareness of air handling problems in at least two papers: "Practical Experience with Dangers and Illnesses from Plastics" by *C. Scott McKinley, M.D.*, Bakelite Corp., and "Practical Experiences with Dangers and Illnesses from Degreasing Agents" by *Harley L. Krieger, M.D.*, Ford Motor Co., and in their heavy attendance at a joint session with AIHA concerning problems incident to atomic energy release.

• **ACGIH.**—First on the scene at Buffalo were the Governmental Industrial Hygienists who convened for committee meetings on Saturday, April 26. Significant of the scope of this organization of city, state, and Federal agents of industrial health were Sunday's round table discussions divided into four groups; chemists, engineers, physicians, and nurses.



*K. M. Morse*

Technical sessions on Monday emphasized the concern of ACGIH not only with techniques of conditioning industrial environment for employee health but also with their own particular problems in code development, plant inspection and enforcement procedures.

For instance, Control of Respiratory Diseases in Industry was the subject of a talk by *Dr. Anna Baetjer*, Johns Hopkins University. Indicative of the government personnel's concern with codes, was a 30-minute discussion period following a paper on the Role of Codes in Industrial Hygiene Administration by *Theodore Waters*, chairman, legal committee, Industrial Hygiene Foundation. Afternoon technical papers included: Use of Plastic Chips in the Control of Chromic Acid Mists, by *Jerome E. Molos*, Industrial Hygiene Section, City of St. Louis; Sodium Fluoride in the Steel Industry, by *Dr. K. B. Markuson*, Michigan Department of Health; Toxicology of 2-nitropropane, by *John B. Skinner*, Massachusetts Department of Labor and Industries.

Committee reports of ACGIH again brought out the importance of developing uniform codes and

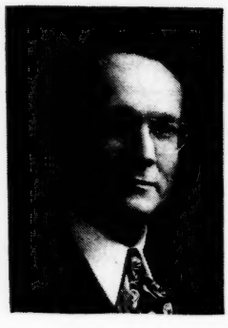
*L. W. Spolyar, M.D.*

*C. D. Yaffee*, Washington Department of Health, chairman of the conference committee on codes, expressed the intention of his committee to develop an overall industrial hygiene code, embracing all aspects of the association's professional activities, within the coming year. *W. B. Harris*, New York State Department of Labor, reported development of code sections on ventilation. Cooperation on the part of the American Standards Association was assured by a spokesman from ASA's New York office.

Presiding at the Monday and Tuesday sessions were *K. M. Morse*, chairman of the conference and *J. J. Bloomfield*, secretary-treasurer. *Dr. Louis W. Spolyar*, vice-chairman in 1946, was elevated to chairman for the coming year.

• **AIHA.**—With technical sessions beginning on Tuesday afternoon, the American Industrial Hygiene Association program evidenced a three-phase concern with problems in industrial hygiene. Toxicology, environmental control, and analytical methods were the three main divisions of their discussions, interspersed with a symposium on dust particle size and a joint meeting with AAIPS covering radiation hazards incident to the use of the atomic bomb at which official motion pictures of the Bikini experiment were shown.

Of special interest to heating and ventilating engineers was the Wednesday afternoon session on environmental control at which *Theodore F. Hatch*, president elect, and *Allen D. Brandt*, secretary, presided. At this session, the Donald E. Cummings Memorial Lecture was presented by *W. P. Yant*, Mine Safety Appliances Co., setting forth the role of the industrial hygienist in bridging the gap between the physician and in-plant health control measures.



*F. A. Patty*

• **VENTILATION.**—Following Dr. Yant's talk, a paper, Ventilation of Cotton Textile Processes, by *Leslie Silverman* and *Frederick Viles, Jr.*, Harvard School of Public Health, was presented by Dr. Silverman and described local ventilation techniques controlling nuisance dust in break-out and carding operations in the manufacture of cotton textiles.

Control measures developed during the war in the handling of mercury and mercuric oxide in the manufacture of the Ruben cell, a new dry battery, were described by *Charles R. Williams*, in a paper prepared jointly by *Dr. Williams, Merrill Eisenbud* and *Stanley E. Pihl*, Liberty Mutual Insurance Co. Special hooding and collecting measures were described and the im-

portance of avoiding mercury spillage and maintaining impervious floor surfaces was emphasized.

A Study of the Hazards of Exposures to Lead and Zinc Fumes in Brass Foundries by *W. W. Stalker*, Kentucky State Department of Health, emphasized the importance of local exhaust ventilation in the control of these fumes.

*T. F. Hatch*

Control of a Lead Hazard in the Brass Foundry Industry, by *L. E. Hamlin* and *H. J. Weber*, American Brake Shoe Co., was presented by Mr. Hamlin, and described the techniques for the prevention of lead absorption by thorough ventilation.

• **ENGINEERING.** — At an evening session consisting of a series of round table conferences, *Professor Phillip Drinker*, Harvard School of Public Health, addressed the group on the subject of Atmospheric Trade Wastes and developed his theme around the growing necessity for controlling atmospheric pollution by industrial plants even in rural areas. Professor Drinker reported that contamination of grazing land by fluoride fume deposits had been a serious complaint in more than one area where sheep or cattle had ingested contaminated grass.

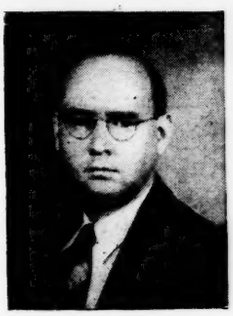
*W. N. Witheridge*, General Motors Corp., presided at a round table conference on engineering techniques at which the subject of unit dust collectors, maximum allowable concentrations, and codes were the principle topics.

• **PARTICLE SIZE.**—At a symposium on particle size, with *Professor Phillip Drinker* and *Carlton E. Brown*, U. S. Bureau of Mines, presiding, the subject of Solid Aerosols was discussed by *B. K. LaMer, J. Q. Umberger*, and *D. Sinclair*, Columbia University. A paper originating at the University of Chicago Laboratory, discussed the relation of particle size to retention in the lung. Particle size in relation to the toxicity of uranium dioxide was discussed in a paper from the School of Medicine and Dentistry, University of Rochester. The influence of particle size in dust exposures, by *Theodore F. Hatch* and *W. C. L. Hemeon*, Industrial Hygiene Foundation, brought out the inverse relationship between particle size and the importance and difficulty of control measures.

*J. H. Sterner, M.D.*

• **INSTRUMENTS.**—In a review of analytical methods at which *H. H. Schrenk*, and *E. C. Barnes* presided, instruments and techniques for the detection and measuring of atmospheric contaminants were discussed in five technical papers. A review of automatic indicating and recording instruments by *Warren A. Cook*, Zurich Insurance Companies, covered the types of instruments commercially available and the uses and limitations of each. A modified Interferometer, was described by *Robert F. Stamm* and demonstrated by *William R. Bradley*, both of the American Cyanamid Co. This instrument detects the presence of contaminants by measuring refractive index differences between normal air in one cell and air plus a gas or vapor contaminant in a comparison cell. *W. G. Fastie*,

*A. D. Brandt*



*C. E. Brown*

Leeds and Northrup Co., discussed methods of infrared gas analysis and described an instrument based on this principle for determining concentration of gases in the atmosphere.

• **OFFICERS.**—At the business meeting of the association, president *Frank A. Patty*, General Motors Corporation, called for reports from *Allen D. Brandt*, Bethlehem Steel Co., secretary, and *Carlton E. Brown*, U. S. Bureau of Mines, treasurer, and introduced incoming president *Theodore F. Hatch*, Industrial Hygiene Foundation, and the incoming president-elect *J. H. Sterner, M.D.*, Eastman Kodak Co. Directors appointed this year for a three-year term were *Dr. Anna M. Baetjer*, Johns Hopkins University; *A. G. Cranch, M.D.*, Union Carbide and Carbon Co. and *N. V. Hendricks*, Standard Oil of New Jersey. These directors will fill vacancies created by the expiring terms of *W. C. L. Hemeon, William R. Bradley*, and *W. N. Witheridge*.

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## WEATHER FOR BUSINESS

**is the subject of a new data service planned by U. S. Weather Bureau. Long range patterns projected for business problems.**

An industrial climatology service has been set up by the U. S. Weather Bureau in an attempt to advise firms planning new factories, new products, or unfamiliar foreign markets. This is not a forecasting service but consists of projecting long range patterns which may influence plant location and construction product design, and the distribution of goods in domestic and export trade.

• **SEEK KNOWLEDGE.**—While the plan was developed during the war, it has only now become feasible, and the Weather Bureau is sending questionnaires to about 50,000 business concerns in an attempt to develop knowledge of industry's needs and to acquaint

business more fully with the service now available to them.

The long range weather patterns, analyses of historical weather information, establish the probability of a specific weather situation during a given time. Once a pattern is determined, a business man can translate it into its effects on his particular problem.

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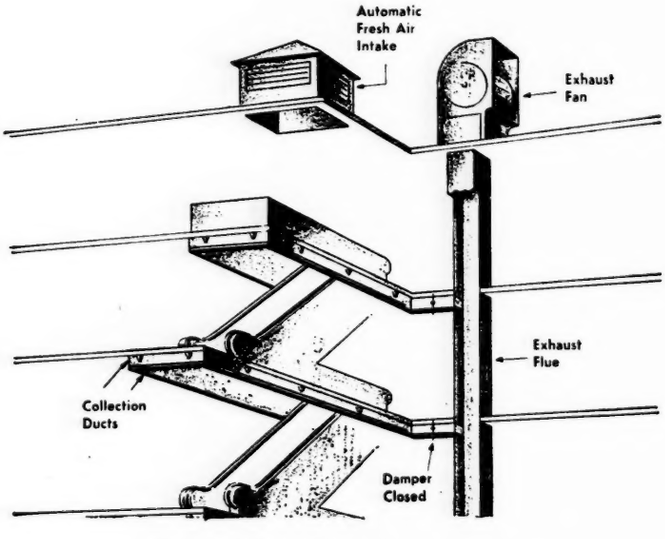
## FIRE HAZARDS REDUCED

**by new protective system that prevents smoke and gases from spreading to upper building floors through wellways.**

As the result of cooperative studies conducted since August, 1946, a new method was developed for saving lives during building fires, by removing the heated fumes and toxic gases resulting from a large size fire. The system, designed particularly for moving stairs found in department stores, uses an exhaust system to remove the hot gases and smoke, and a water curtain to prevent these products of combustion reaching upper floors through the wellway.

Experimental work was conducted in a two story building at the Cranston, R. I., proving ground of Grinnell Co., Inc. Research was carried on by Grinnell, Otis Elevator Co., and Westinghouse Electric Corp. Tests were conducted with full size moving stair mock-ups in a special two-story test building.

• **COLLECTION DUCTS.**—At each wellway opening of the moving stairway, a collection duct at the front




**Details of the protective system.**

and two sides of the well connects with a vertical duct that leads to an exhaust fan on the roof. The collection duct has narrow slots for the admission of the air to be exhausted and a damper near the vertical duct or riser. On the roof, directly over the moving stairway well, is an intake for fresh air. A set of high velocity sprinkler heads is directed down the wellway on each floor to form a water curtain around the moving stairs. Where desired, a secondary set of sprinklers to deluge the stairway with water can be provided for an additional fire protection reserve.

• **OPERATION.** — In operation, when a fire develops, the sprinkler head in the fire zone lets go. The flow

**Slotted collection ducts surround three sides of the wellway. Around the ducts are the sprinklers which form the water curtain in the event of fire.**

of water in the automatic sprinkler system actuates controls which open up the fresh air inlet on the roof, opens the damper connecting the exhaust duct for that floor with the vertical riser, and starts the exhaust blower. A negative pressure is created in the vicinity of the wellway and fresh air is drawn down from the roof inlet. This reverses the normal flow of air through the floor openings and prevents these well ways functioning like a chimney. It also opposes and retards any upward currents established by the fire.

A set of open sprinklers provide a water curtain around the wellway which cools the hot gases and prevents smoke from rising to upper floors. The water curtain is so located in relation with the duct that flames cannot be drawn into the duct through the slots. At the same time that these previously mentioned actions are taking place, an alarm is transmitted to the fire department, moving stairways in the vicinity of the fire are stopped, and if the property has an air conditioning system, it is shut down.

Very hot fires will set off the high velocity spray heads over the center of the wellway of the floor involved. Although only extreme conditions will bring these heads into play, their use is recommended for installations where a flash fire near the wellway can suddenly produce heat in that space.

• **AIR MOVEMENT.** — Gases and smoke are drawn through the slots in the ducts, travel to the riser and are then discharged outdoors by the exhaust blower on the roof. Air movement around the slot is about 2,000 fpm; in the duct about 1,000 fpm; and the velocity of fresh air down the well, 300 fpm.

Each installation will have to be treated as a separate engineering problem. Present indication is that a J. C. Penney Co., store in Cincinnati, Ohio, will be the first installation for the system described.

# TRAIN OF TOMORROW

**on national tour, features latest air conditioning, refrigeration, and passenger comfort design.**

The General Motors Train of Tomorrow, carrying a variety of innovations in railway travel, rolled into Soldier Field, Chicago, May 28, on the first lap of a six-months nationwide tour which will take it to more than 30 cities in America for public exhibition. The train was open for public inspection at Soldier Field through June 2 after which it went to Detroit.

• **PURPOSE.** — C. E. Wilson, president of General Motors, described the train as a research project aimed to augment the service of railroads to the public. He emphasized that his company has no intention of entering the field of railway passenger car construction. The project grew as an idea in General Motors, he said, because of the interest in modern railway transportation of its Electro-Motive Division, builders of Diesel locomotives, and a number of other GM divisions which are large suppliers of railway equipment needs.

The four cars of the train were designed by General Motors and built for it by the Pullman-Standard Car Manufacturing Co. The unit includes most of the required types of cars — diner, sleeper, coach and observation lounge car—each having the Astra-Dome, a raised observation space for 24 passengers in the center of the car, and the varied floor levels that make it different from anything previously operated on rails.

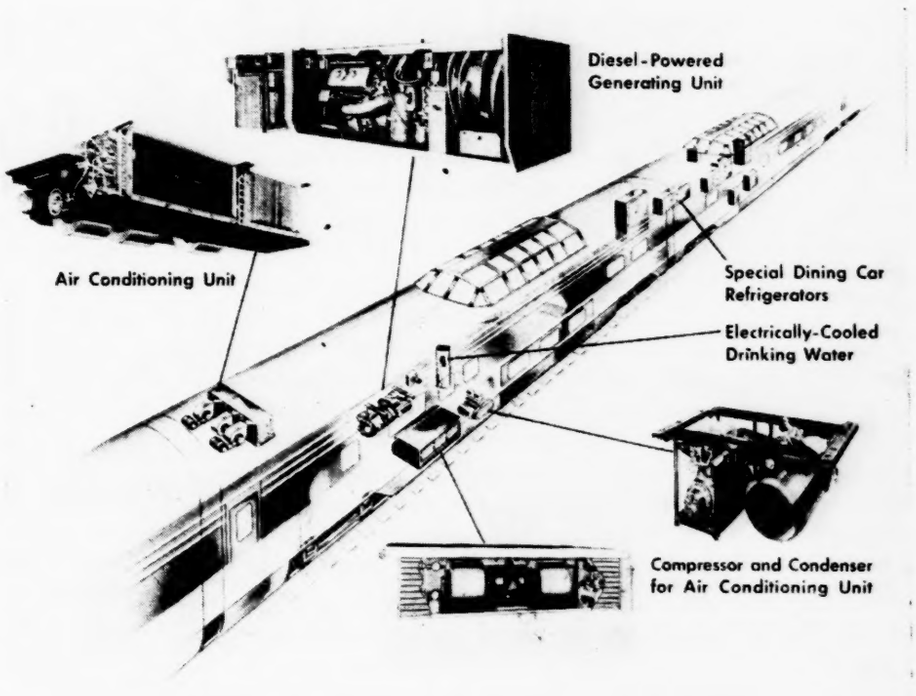
• **FIRSTS.**—The Train of Tomorrow has a considerable number of "firsts"—an independent diesel power system for each car; a four-level floor space; an all-electric kitchen; the Astra-Dome-lower-level combinations; train-to-home telephone; wire-recorded entertainment; new type of outside swing hanger springing system which minimizes bumpiness and side-sway; and specially-developed journals which also contribute to easier riding. The dome feature, enclosed by heat-resistant and non-glare safety glass, is outstanding on this train. The effort to provide a car with this ideal observation space was the originating move that led to the entire train's design and construction.

• **POWER PACKAGE.**—An adequate source of electrical power was a necessary step in the development of improved air conditioning, refrigeration, ventilation, heating and lighting. Today a single modern car requires as much as 25kw of generating capacity to supply these facilities. A fully-equipped dining car, complete with electric cooking facilities may require as much as 60kw—enough to light 100 average homes. Frigidaire engineers examined the limtations of existing railway car electrical systems, surveyed probable future requirements, and then designed an entirely new type of generating unit to meet their requirement. This compact, "power-package," developed with the cooperation of Detroit Diesel Engine and Delco Products Divisions of General Motors, provides each car with its own individual source of electricity for air conditioning, ventilating, refrigeration, and lighting.

The individual car power unit consists of a three-cylinder, 1200 rpm Diesel engine connected directly to a "split alternator" (actually two alternating-current generators built on a common shaft and within a common frame). A 15kw generator supplies 220-volt, 60 cycle current for operating air conditioning and refrigeration equipment. A 120-volt 60 cycle generator of 10kw capacity, furnishes current for lighting and ventilation and also for radio sets, electric shavers and other small devices. Mounted on the side of the alternator housing, and driven from the extended alternator shaft, is a 38-volt, 1800 rpm direct-current generator supplying approximately 3 kw. This generator excites the fields of the split-alternator and charges the storage battery required for engine cranking, controls, and emergency lights.

Numerous advantages are inherent in the "power-package." There is a significant load reduction for the locomotive with the elimination of constant drag of axle-driven generators. Compared with the axle-driven equipment, these units save as much as 600 hp (engine load) on a 12-car train, permitting faster acceleration and longer trains. The weight of the storage battery has been reduced approximately 3,500 lb per car. The new unit permits the use of standard alternating current devices and also permits full use of these devices while a car is stationary or even uncoupled from the train.

• **AIR CONDITIONING.**—The astra-dome cars, making up the "Train of Tomorrow," with their large areas of glass exposed to the sun, require greater refrigera-


Diesel-Powered Generating Unit
Air Conditioning Unit
Special Dining Car Refrigerators
Electrically-Cooled Drinking Water
Compressor and Condenser for Air Conditioning Unit

**Sectional view of General Motors' Train of Tomorrow**

tion capacity for air conditioning than the conventional car. While the air conditioning installations on this new train are similar in many ways to equipment now in use, certain basic improvements were introduced to provide this increased capacity. Of particular importance is the flooded-type under-car condenser unit, which allows the system to operate at greater efficiency, producing the extra cooling capacity required without using additional power.

A modulating frigidaire air conditioning system of 10 tons cooling capacity is installed in each car. Six tons capacity are directed to the lower compartments of the car and four additional tons are directed to the astra-dome compartment. Cooling is accomplished by the evaporation of Freon refrigerant. Heat, when required, is supplied by a steam coil over which the air passes. A control system provides automatic regulation of the conditioner so that it will maintain comfortable temperature and humidity conditions within the car—summer or winter.

Two air conditioning units are suspended side-by-side above the ceiling at one end of the car. The larger unit, which supplies conditioned air to the lower car space, consists of two centrifugal type blowers, driven by a one-horsepower electric motor; a cooling unit; a heating unit; a drain pan to collect moisture condensed from the air, and necessary control valves and connections. The blower assembly is isolated from the car and from the rest of the unit by means of rubber mounting supports and flexible ducts, providing quiet, vibration-free operation.

The smaller unit, which supplies conditioned air to the dome compartment of the car, is similar in construction, but has only one blower, driven by a one-half horsepower motor. The cooling and heating units are also smaller.

Cooling units are divided into upper and lower sections to permit operation at one-half or full cooling capacity. Each section has a thermostatic expansion valve to regulate the flow of refrigerant according to the cooling requirements, plus a distribution manifold, which meters an equal quantity of refrigerant to each of the parallel passages through the unit. Thus, uniform cooling and dehumidification are assured.

Finned heating coils are located directly behind the cooling units. When heating is required, these coils are connected to lines from a steam generator in the locomotive. Ducts, concealed in the car ceiling, deliver conditioned air to all passenger compartments, through special discharge grilles designed to eliminate drafts. blowers operate continuously, circulating 2,800 cfm. One thousand cubic feet per minute are delivered to the dome compartment and 1,800 to the lower section of the car. Seven hundred cubic feet of filtered fresh air is introduced into the system each minute to replace air exhausted from the car, and to assure adequate ventilation. Recirculated air is filtered and deodorized to remove dust, smoke and odors.

The Frigidaire compressor-motor unit consists of a rugged, four-cylinder, vertical, reciprocating, Freon compressor, driven by an enclosed 15-hp motor. It is suspended under the car on shock-absorbing mounts, fully accessible for maintenance and service.

The specially-designed "flooded-type" condenser unit consists of a stainless-steel enclosure in which a finned condenser coil is cooled by two centrifugal-type blower, driven by a 1-hp motor. The cooling effect of the air is increased by discharging water onto the finned condenser coil at the rate of 600 gallons per hour. A one-fourth horsepower electric pump delivers the water to the discharge nozzles from a 180 gallon tank built into the lower section of the unit. A small part of the water is evaporated on the coils and the remainder drains back into the tank and is recirculated. Baffles within the tank minimize the surging of water when the car is in motion.

Air is blown through the condenser coil from below, while the water is sprayed from above. As a result of this counter-flow, the air is washed before it strikes the coil, and the coil surfaces remain clean, assuring a rapid heat transfer. Dirt washed out of the air is collected in traps from which it is emptied easily. A liquid refrigerant receiver within the enclosure is made of brass and the entire unit is constructed of corrosion-resistant materials. This unit is also suspended under the car.

Thermostats control automatically the operation of the air conditioning equipment. When cooling is required, the compressor and condenser units operate until the desired temperature is attained. The thermostatic control then automatically closes an electrically operated valve, shutting off the flow of refrigerant to the upper section of the cooling unit. At the same time, a similar valve on the compressor unit opens to by-pass two cylinders of the compressor, thus reducing its pumping capacity by approximately one-half.

• **REFRIGERATION.**—Refrigerated fixtures in each car operate automatically to maintain required temperatures, ranging from 50F for drinking water to zero for frozen foods.

The dining car has eleven separate refrigerated fixtures providing a total of 111 cu ft of storage space—more than that provided in 15 standard-size household refrigerators. Four compact Frigidaire condensing units, concealed at different locations in the car, furnish dependable refrigeration for various fixtures.

Cooled, fresh water is constantly circulated throughout the sleeping car and is on tap in all compartments. A special Frigidaire tank-type water cooler, concealed at the left of the rear vestibule, chills three gallons of water per hour, with refrigeration being supplied by a condensing unit near the cooler.

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## WATER HEATER SIZING

**for hotels, apartments and restaurants will be averaged and charted by West Coast committee.**

Comprehensive data on water heating requirements for hotels, apartment houses, motels and restaurants in the 11 western states was presented at a meeting in

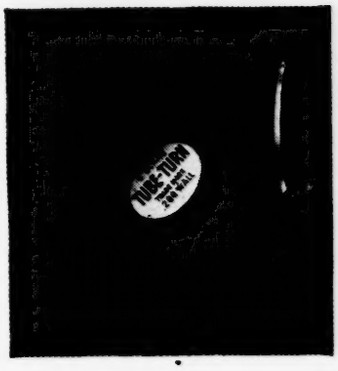
*(Continued on page 137)*

# "Half-inch or Thirty!"

You don't do much shopping around for the fittings you need when you deal with the Tube Turns distributor. He's got 'em or can get 'em for you, fast—welding elbows ranging in diameter from tiny half-inch to a mighty thirty inches, welding fittings of all types and thicknesses in a wide range of sizes.

Tube Turns' complete line of TUBE-TURN welding fittings and flanges in grade A and grade B carbon steels contains more regularly manufactured items than any other line—more than 4,000! And this is supplemented by an extensive selection of items in a wide range of special metals and alloys—stainless steels, carbon moly steels, chrome moly steels, copper, aluminum, brass, monel metal, inconel, nickel, wrought iron.

Write for the name of your nearest Tube Turns distributor, and for facts about how the fittings that become part of the pipe serve others in your industry.

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**TUBE-TURN** TRADE MARK **tt** *Welding Fittings and Flanges*

ONE SOURCE OF SUPPLY FOR ALL WELDING FITTING REQUIREMENTS

# Degree-Days for April, 1947

HEATING AND VENTILATING's 20th Year of Publication of Monthly Degree-Day Data

| City | April | | | Cumulative, Sept. 1, 1946 to April 30, 1947 | | | Heating Season[1] |
|---|---|---|---|---|---|---|---|
| | 1947 | 1946 | Normal | 1946-47 | 1945-46 | Normal | Normal |
| Abilene, Texas | 152 | 27 | 27 | 2815 | 2361 | 2061 | 2061 |
| Albany, New York | 650 | 608 | 549 | 6348 | 6466 | 6397 | 6580 |
| Albuquerque, New Mexico | 318 | 125 | 288 | 4241 | 4166 | 4258 | 4298 |
| Alpena, Michigan | 818 | 712 | 789 | 7275 | 7126 | 7662 | 8299* |
| Anaconda, Montana | 731 | 621 | 756 | 7680 | 6959 | 7493 | 8357** |
| Asheville, North Carolina | 190 | 229 | 330 | 3946 | 3829 | 4161 | 4232 |
| Atlanta, Georgia | 76 | 102 | 132 | 2830 | 2756 | 2890 | 2890 |
| Atlantic City, New Jersey | 481 | 432 | 519 | 4287 | 4396 | 4956 | 5176 |
| Augusta, Georgia | 32 | 77 | 24 | 2175 | 2100 | 2161 | 2161 |
| Baker, Oregon | 569 | 539 | 615 | 6383 | 6362 | 6519 | 7163 |
| Baltimore, Maryland | 302 | 290 | 348 | 3945 | 3943 | 4511 | 4533 |
| Billings, Montana | 585 | 367 | 534 | 7034 | 5977 | 6743 | 7119 |
| Binghamton, New York | 576 | 607 | 594 | 5892 | 6033 | 6554 | 6808 |
| Birmingham, Alabama | 84 | 83 | 69 | 2742 | 2635 | 2352 | 2352 |
| Bismarck, North Dakota | 708 | 433 | 657 | 8506 | 8275 | 8809 | 9192 |
| Block Island, Rhode Island | 618 | 606 | 633 | 4883 | 5187 | 5311 | 5788 |
| Boise, Idaho | 469 | 401 | 435 | 5633 | 5396 | 5316 | 5552 |
| Boston, Massachusetts | 537 | 565 | 570 | 5123 | 5465 | 5800 | 6045 |
| Bozeman, Montana | 660 | 522 | 731 | 7369 | 7071 | 7724 | 8521** |
| Buffalo, New York | 651 | 620 | 675 | 6075 | 6148 | 6475 | 6822 |
| Burlington, Vermont | 734 | 689 | 654 | 7029 | 7242 | 7238 | 7514 |
| Butte, Montana | 749 | 643 | 741 | 8084 | 7462 | 7424 | 8272 |
| Cairo, Illinois | 186 | 114 | 201 | 3722 | 3366 | 3909 | 3909 |
| Canton, New York | 744 | 688 | 684 | 7307 | 7507 | 7686 | 8020 |
| Charles City, Iowa | 629 | 386 | 612 | 6968 | 6838 | 7364 | 7588 |
| Charleston, South Carolina | 35 | 63 | 36 | 1714 | 1737 | 1769 | 1769 |
| Charlotte, North Carolina | 103 | 141 | 159 | 2982 | 2850 | 3120 | 3120 |
| Chattanooga, Tennessee | 109 | 119 | 144 | 3361 | 3151 | 3118 | 3118 |
| Cheyenne, Wyoming | 750 | 483 | 720 | 6989 | 6320 | 6894 | 7466 |
| Chicago, Illinois | 546 | 416 | 518 | 5641 | 5525 | 5764 | 6077 |
| Cincinnati, Ohio | 294 | 275 | 333 | 4318 | 4247 | 4684 | 4684 |
| Cleveland, Ohio | 547 | 508 | 564 | 5570 | 5356 | 5935 | 6155 |
| Columbia, Missouri | 346 | 206 | 303 | 4743 | 4320 | 4900 | 4922 |
| Columbia, South Carolina | 40 | 98 | 63 | 2277 | 2259 | 2364 | 2364 |
| Columbus, Ohio | 392 | 390 | 420 | 5002 | 4851 | 5311 | 5398 |
| Concord, New Hampshire | 705 | 684 | 669 | 6831 | 7084 | 7001 | 7353 |
| Concordia, Kansas | 444 | 206 | 342 | 5338 | 4535 | 5250 | 5315 |
| Dallas, Texas | 95 | 22 | 9 | 2465 | 2085 | 2256 | 2256 |
| Davenport, Iowa | 470 | 314 | 453 | 5782 | 5659 | 6171 | 6289 |
| Dayton, Ohio | 463 | 408 | 396 | 5420 | 5248 | 5183 | 5264 |
| Denver, Colorado | 552 | 265 | 534 | 5569 | 4819 | 5607 | 5874 |
| Des Moines, Iowa | 493 | 282 | 441 | 6081 | 5651 | 6266 | 6384 |
| Detroit, Michigan | 609 | 517 | 573 | 5928 | 5815 | 6264 | 6490 |
| Devils Lake, North Dakota | 760 | 537 | 756 | 9332 | 9417 | 9450 | 9970 |
| Dodge City, Kansas | 445 | 171 | 342 | 5096 | 4310 | 4988 | 5035 |
| Dubuque, Iowa | 544 | 339 | 489 | 6312 | 6153 | 6641 | 6790 |
| Duluth, Minnesota | 866 | 668 | 801 | 8741 | 8555 | 8746 | 9483 |
| Eastport, Maine | 812 | 819 | 786 | 6777 | 7183 | 7398 | 8520** |
| Elkins, West Virginia | 371 | 485 | 501 | 5453 | 5279 | 5520 | 5697 |
| El Paso, Texas | 148 | 13 | 45 | 2533 | 2707 | 2428 | 2428 |
| Ely, Nevada | 714 | 598 | (a) | 7000 | 7044 | (a) | (a) |
| Erie, Pennsylvania | 593 | 549 | 609 | 5505 | 5469 | 6016 | 6273 |
| Escanaba, Michigan | (a) | 714 | 828 | (a) | 7522 | 8118 | 8771* |
| Evansville, Indiana | 285 | 218 | 276 | 4505 | 4162 | 4244 | 4244 |
| Fort Smith, Arkansas | 144 | 75 | 93 | 3303 | 3012 | 3147 | 3147 |
| Fort Wayne, Indiana | 544 | 481 | 474 | 5954 | 5845 | 5795 | 5925 |
| Fort Worth, Texas | 104 | 28 | 27 | 2513 | 2127 | 2148 | 2148 |
| Fresno, California | 82 | 100 | 135 | 2548 | 2419 | 2334 | 2334 |
| Galveston, Texas | 18 | 1 | 0 | 1407 | 1045 | 1016 | 1016 |
| Grand Junction, Colorado | 425 | 229 | 384 | 5575 | 5298 | 5430 | 5548 |
| Grand Rapids, Michigan | 584 | 487 | 534 | 5986 | 5933 | 6361 | 6535 |
| Green Bay, Wisconsin | 727 | 549 | 600 | 7263 | 7199 | 7503 | 7825 |
| Greensboro, North Carolina | 175 | 215 | 210 | 3680 | 3608 | 3529 | 3529 |
| Greenville, South Carolina | 100 | 149 | 195 | 3036 | 3015 | 3380 | 3380 |
| Harrisburg, Pennsylvania | 393 | 404 | 405 | 4910 | 4973 | 5285 | 5375 |
| Hartford, Connecticut | 557 | 549 | 531 | 5536 | 5906 | 5834 | 6036 |
| Hatteras, North Carolina | 157 | 234 | 255 | 2203 | 2398 | 2571 | 2571 |
| Havre, Montana | 552 | 434 | 630 | 8277 | 7061 | 8187 | 8700 |
| Helena, Montana | 622 | 506 | 646 | 7545 | 6600 | 7261 | 7898 |
| Houston, Texas | 33 | 3 | 0 | 1489 | 1188 | 1157 | 1157 |
| Huron, South Dakota | 677 | 386 | 570 | 7592 | 7317 | 7737 | 8004 |
| Indianapolis, Indiana | 392 | 333 | 384 | 4984 | 4826 | 5239 | 5298 |
| Jackson, Mississippi | 48 | 30 | (a) | 2228 | 2073 | (a) | (a) |
| Kansas City, Missouri | 342 | 183 | 306 | 4742 | 4226 | 4950 | 4956 |
| Kewanee, Illinois | 457 | 407 | 472 | 5817 | 5533 | 5996 | 6139 |
| Knoxville, Tennessee | 115 | 145 | 210 | 3566 | 3318 | 3670 | 3670 |
| La Crosse, Wisconsin | 660 | 441 | 528 | 7246 | 7102 | 7139 | 7322 |
| Lander, Wyoming | 724 | 459 | 690 | 7435 | 6906 | 7384 | 7947 |

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with nine exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, Sioux City, and Jackson, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill.; Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, and H. M. Ludlow, Box 1368, Jackson, Miss., respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on Page 120]

# REVERE COPPER WATER TUBE
## takes skilled work—but not "Bull Work"

NEARLY everyone knows that heating and plumbing lines of Revere Copper Water Tube give years of continuous, trouble-free service. But that's not all! Revere Copper Water Tube offers many advantages to skilled journeymen and to contractors at the time of installation.

Hard and soft Type K and soft Type L tube in sizes up to 1" inclusive may be neatly bent to meet installation needs, thus saving many fittings. There is no need for thread cutting because where joints are necessary, they are quickly made—even in cramped spaces—with solder or compression fittings. Pipe covering can usually be omitted from relatively short runs without significant heat losses. And, in addition, you can frequently install Revere Copper Water Tube one size smaller than would be required for rustable pipe.

Look for the Revere name and the type, which are stamped on Revere Copper Water Tube at regular intervals. These marks are more than identification—they are your assurance of full wall thickness and the close gauge tolerances so essential for tight sweated joints.

You can specify or install, in addition to Revere Copper Water Tube, such other long-lived Revere materials as Red-Brass Pipe; Sheet Copper and Sheet Herculoy for tanks, ducts, pans and trays; Dryseal Copper Refrigeration Tube (dehydrated and sealed); Copper oil burner, heat control and capillary tubes.

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TROUBLE ALWAYS COSTS MORE THAN REVERE COPPER WATER TUBE

# Degree-Days for April, 1947 (Concluded)

HEATING AND VENTILATING's 20th Year of Publication of Monthly Degree-Day Data

| City | April | | | Cumulative, Sept. 1, 1946 to April 30, 1947 | | | Season[1] Heating |
|---|---|---|---|---|---|---|---|
| | 1947 | 1946 | Normal | 1946-47 | 1945-46 | Normal | Normal |
| Lansing, Michigan | 633 | 545 | 582 | 6382 | 6340 | 6819 | 7048 |
| Lewiston, Maine | 734 | 701 | 693 | 6942 | 7344 | 7318 | 7707 |
| Lincoln, Nebraska | 473 | 216 | 417 | 5657 | 4967 | 5900 | 5999 |
| Little Rock, Arkansas | 117 | 75 | 78 | 3077 | 2821 | 2811 | 2811 |
| Livingston, Montana | 653 | 492 | 653 | 7124 | 6226 | 6638 | 7205 |
| Los Angeles, California | 128 | 118 | 159 | 1268 | 1291 | 1414 | 1504 |
| Louisville, Kentucky | 242 | 222 | 264 | 4140 | 3837 | 4180 | 4180 |
| Lynchburg, Virginia | 244 | 257 | 273 | 4050 | 3950 | 3980 | 3980 |
| Macon, Georgia | 39 | 75 | 33 | 2264 | 2169 | 2201 | 2201 |
| Madison, Wisconsin | 617 | 446 | 582 | 6758 | 6702 | 7193 | 7429 |
| Marquette, Michigan | 922 | 695 | 804 | 7719 | 7483 | 7968 | 8693* |
| Memphis, Tennessee | 107 | 79 | 96 | 3115 | 2944 | 2950 | 2950 |
| Meridian, Mississippi | 66 | 45 | 24 | 2333 | 2108 | 2160 | 2160 |
| Milwaukee, Wisconsin | 665 | 540 | 648 | 6696 | 6423 | 6856 | 7245 |
| Minneapolis, Minnesota | 685 | 422 | 570 | 7529 | 7346 | 7614 | 7850 |
| Modena, Utah | 562 | 452 | 579 | 5946 | 5888 | 6170 | 6562 |
| Montgomery, Alabama | 37 | 36 | 0 | 1958 | 1925 | 1884 | 1884 |
| Nantucket, Massachusetts | 649 | 650 | 639 | 5118 | 5235 | 5450 | 5957 |
| Nashville, Tennessee | 146 | 132 | 180 | 3553 | 3342 | 3507 | 3507 |
| New Haven, Connecticut | 566 | 567 | 543 | 5329 | 5658 | 5672 | 5895 |
| New Orleans, Louisiana | 3 | 3 | 0 | 1219 | 1108 | 1024 | 1024 |
| New York, New York | 453 | 457 | 465 | 4617 | 4731 | 5073 | 5274*** |
| *Nome, Alaska | 2004 | 2131 | 1756 | 11003 | 10888 | 10642 | 14580** |
| Norfolk, Virginia | 216 | 230 | 246 | 3009 | 3015 | 3350 | 3350 |
| North Head, Washington | 424 | 532 | 516 | 4160 | 4326 | 4271 | 5452** |
| North Platte, Nebraska | 537 | 263 | 486 | 6092 | 5288 | 6167 | 6366 |
| Oakland, California | 211 | 329 | 273 | 2733 | 2859 | 2665 | 3143** |
| Oklahoma City, Oklahoma | 217 | 81 | 162 | 3543 | 3075 | 3613 | 3613 |
| Omaha, Nebraska | (a) | 242 | 414 | (a) | 5374 | 6047 | 6131 |
| Oswego, New York | 662 | 657 | 675 | 6140 | 6340 | 6668 | 7088 |
| Parkersburg, West Virginia | 273 | 335 | 351 | 4476 | 4347 | 4722 | 4775 |
| Peoria, Illinois | 456 | 343 | 453 | 5758 | 5562 | 5988 | 6109 |
| Philadelphia, Pennsylvania | 354 | 366 | 378 | 4240 | 4340 | 4605 | 4737*** |
| Phoenix, Arizona | 21 | 12 | 0 | 1278 | 1479 | 1405 | 1405 |
| Pittsburgh, Pennsylvania | 394 | 412 | 423 | 5170 | 4697 | 5157 | 5235 |
| Pocatello, Idaho | 572 | 431 | 567 | 6363 | 6410 | 6263 | 6655 |
| Portland, Maine | 711 | 735 | 666 | 6703 | 7128 | 7137 | 7218 |
| Portland, Oregon | 291 | 368 | 402 | 3718 | 3814 | 4134 | 4469 |
| Providence, Rhode Island | 509 | 525 | 558 | 4989 | 5255 | 5764 | 6015 |
| Pueblo, Colorado | 473 | 223 | 456 | 5669 | 5014 | 5328 | 5514 |
| Raleigh, North Carolina | 136 | 197 | 183 | 3056 | 3084 | 3234 | 3234 |
| Rapid City, South Dakota | 653 | 380 | 594 | 7236 | 6055 | 6744 | 7118 |
| Reading, Pennsylvania | 389 | 399 | 417 | 4677 | 4787 | 5293 | 5389 |
| Red Bluff, California | 116 | 138 | (a) | 2543 | 2687 | (a) | (a) |
| Reno, Nevada | 498 | 476 | 534 | 5365 | 5320 | 5436 | 5892 |
| Richmond, Virginia | 229 | 232 | 246 | 3532 | 3549 | 3695 | 3695 |
| Rochester, New York | 618 | 618 | 618 | 6116 | 6296 | 6472 | 6732 |
| Roseburg, Oregon | 318 | 386 | 411 | 3942 | 3770 | 4047 | 4428 |
| Roswell, New Mexico | 228 | 59 | 180 | 3452 | 3154 | 3484 | 3484 |
| Sacramento, California | 129 | 166 | 207 | 2653 | 2552 | 2600 | 3653 |
| St. Joseph, Missouri | 371 | 213 | 342 | 5088 | 4603 | 5145 | 5161 |
| St. Louis, Missouri | 287 | 178 | 276 | 4386 | 4024 | 4585 | 4585 |
| Salt Lake City, Utah | 494 | 318 | 453 | 5623 | 5388 | 5319 | 5555 |
| San Antonio, Texas | 61 | 8 | 0 | 1844 | 1508 | 1202 | 1202 |
| San Diego, California | 102 | 91 | 174 | 1295 | 1317 | 1524 | 1645 |
| Sandusky, Ohio | 542 | 465 | 726 | 5432 | 5339 | 6025 | 6208 |
| San Francisco, California | 224 | 293 | 294 | 2401 | 2362 | 2417 | 3264** |
| Sault Ste. Marie, Michigan | 956 | 817 | 819 | 8269 | 8230 | 8448 | 9285** |
| Savannah, Georgia | 25 | 41 | 0 | 1519 | 1581 | 1490 | 1490 |
| Scranton, Pennsylvania | 517 | 528 | 513 | 5561 | 5603 | 5958 | 6129 |
| Seattle, Washington | 331 | 421 | 462 | 4035 | 3984 | 4379 | 4934** |
| Sheridan, Wyoming | 659 | 378 | 648 | 7310 | 6351 | 7485 | 8008 |
| Shreveport, Louisiana | 48 | 30 | 0 | 2272 | 2033 | 1938 | 1938 |
| Sioux City, Iowa | 573 | 339 | 489 | 6834 | 6278 | 6734 | 6898 |
| Spokane, Washington | 502 | 512 | 504 | 6044 | 5790 | 5989 | 6355 |
| Springfield, Illinois | 380 | 257 | 366 | 5054 | 4714 | 5317 | 5373 |
| Springfield, Missouri | 287 | 176 | 267 | 4551 | 4067 | 4416 | 4428 |
| Syracuse, New York | 610 | 618 | 630 | 6198 | 6320 | 6614 | 6893 |
| Tacoma, Washington | 383 | 459 | 465 | 4384 | 4340 | 4551 | 5181** |
| Terre Haute, Indiana | 380 | 282 | 333 | 4939 | 4609 | 4872 | 4872 |
| Toledo, Ohio | 577 | 513 | 525 | 5900 | 5811 | 5897 | 6077 |
| Topeka, Kansas | 356 | 187 | 300 | 4852 | 4211 | 4935 | 4969 |
| Trenton, New Jersey | 408 | 423 | 402 | 4592 | 4748 | 4852 | 4933 |
| Utica, New York | 615 | 625 | 588 | 5744 | 7235 | 6543 | 6796 |
| Valentine, Nebraska | 624 | 325 | 561 | 6929 | 5966 | 6766 | 7039 |
| Walla Walla, Washington | 304 | 332 | 363 | 4519 | 4281 | 4637 | 4808 |
| Washington, D. C. | 255 | 285 | 348 | 3915 | 3951 | 4601 | 4626 |
| Wichita, Kansas | 352 | 156 | 252 | 4613 | 3977 | 4673 | 4673 |
| Williston, North Dakota | 711 | 439 | 669 | 8744 | 8297 | 8907 | 9323 |
| Winnemucca, Nevada | 484 | 413 | 539 | 5661 | 5590 | 5950 | 6427** |
| Yakima, Washington | 343 | 367 | 360 | 5400 | 4958 | 5413 | 5599 |

(a) Data not available.
†Nome data are for March.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

# A LITTLE BIRD TOLD US *You Want* DIMENSO

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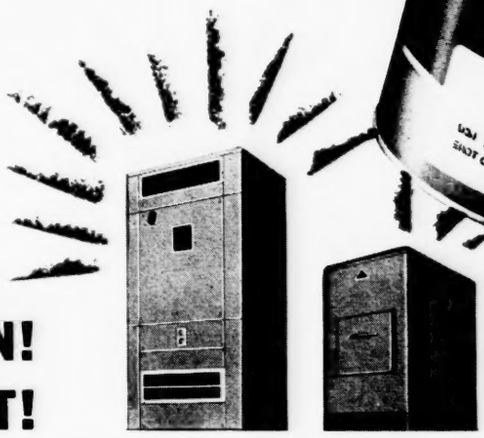

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# SHERWIN-WILLIAMS INDUSTRIAL FINISHES

# Abstracts and Reviews

*Publications abstracted in this department should be ordered direct from publisher.*

## INFLUENCE OF CLIMATE

A scientific study of the development of nations and groups of people projected against the climatic conditions of various countries in all parts of the world, is presented in Climate and the Energy of Nations by S. F. Markham.

He points out that an important influence on the pattern of civilization is that zone bounded or limited by the 70 degree isotherm. In order to reach his conclusions, the author examines national energy, infant mortality, national incomes and world trade and interprets his findings with the climatic conditions of various parts of the world.

In this world-wide study, three chapters are devoted specifically with climate and energy in the United States. One chapter is concerned with air conditioning and its influence on the habits of Americans. In this Mr. Markham said:

"The greatest contribution to civilization in this country may well be air conditioning—and America leads the way. This development may, and I think it will, change the whole course of history in the United States.

This is not a new book. The first American edition was published in 1943. However, this second American edition has two important revisions, and an additional chapter on the Bretton Woods Assessment."

Some of the chapters covered are Climate as a Factor, Human Reactions, The Ideal Outdoor Climate, Climate and History, The Coal Civilizations, Tests of National Energy, The United States: Climate and History, and Climate and Energy, and Air Conditioning. The appendix includes Climatic Conditions of Various Countries, and U. S. Climatological Data.

This book provides an interesting study of history, economics and the development of civilization, examined from the perspective of climate.

*Climate and the Energy of Nations, by S. F. Markham. Cloth bound; 5½ x 8½ in., 240 pages. Published by Oxford University Press, 114 5th Ave., New York, N. Y. Price, $4.50.*

• • •

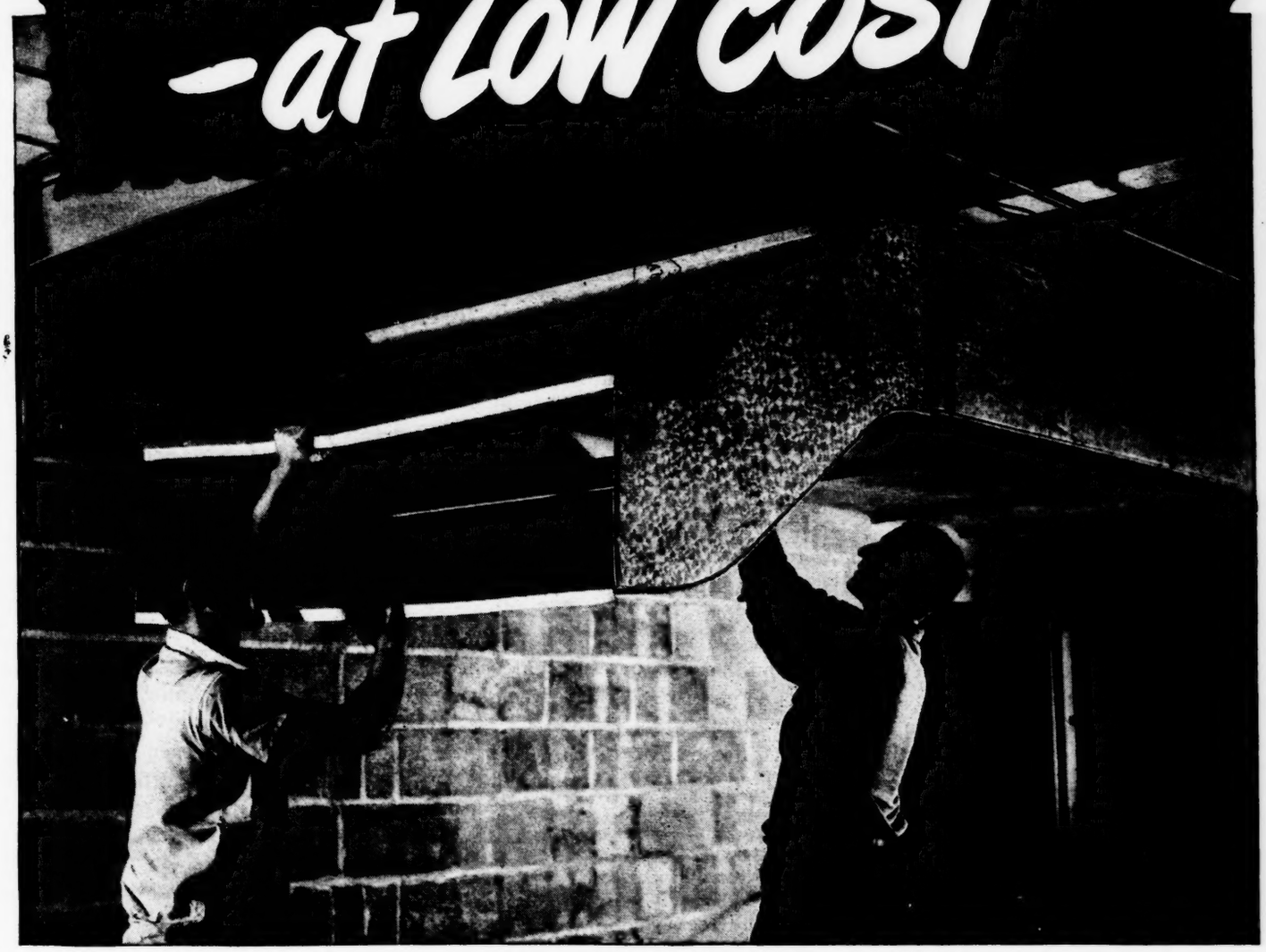
STORAGE TYPE HOT WATER HEATER.—In Bulletin Series No. 366, Alonzo P. Kratz and Warren S. Harris report on Performance of an Indirect Storage Type of Hot Water Heater. This 42-page bulletin discusses the tests made in the I-B-R research home. Tests were made to determine at various boiler water temperatures, the daily fuel consumption chargeable to heat losses from the boiler, heat losses from the storage tank and piping, and actual heating of the water; to determine the relation between the temperature of the water in the storage tank and the temperature of the water in the boiler; to determine the rate of heating water and the maximum water heating load on the boiler; and to determine the maximum quantity of water, at a temperature above a specified minimum that could be drawn off at any one time. A 30-gallon hot water storage tank was used. The investigation is still in progress and subsequent findings will be published at a later date. Copies of the bulletin, 50 cents each, can be obtained from The Engineering Experiment Station, University of Illinois, Urbana, Ill.

TEMPERATURE DISTRIBUTION IN A BUNGALOW.—Temperature distributions with various types of heating devices or systems were determined in a test bungalow at the National Bureau of Standards and reported by Richard S. Dill and Paul R. Achenbach in Temperature Distribution in a Test Bungalow With Various Heating Devices. Heating appliances tested included a hot water heating system, floor furnaces located in several different positions, space heaters with fans, and electric and oil-burning warm air furnaces. Each heating device was observed under a variety of weather conditions. Copies of BMS108, 10 cents each, may be obtained from Superintendent of Documents, U. S. Government printing office, Washington 25, D. C. A condensed report of the results of the tests was published in the February and March, 1947, issues of HEATING AND VENTILATING.

AMERICAN STANDARD PIPE THREADS — A 52-page booklet (B2.1-1945) covers the specifications, dimensions and gaging for taper and straight pipe threads including certain special applications. These ASA standards are sponsored by the American Gas Association, and the American Society of Mechanical Engineers. Copies at $1.50 each may be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York, N. Y.

WELDING ELECTRODES—Tentative Specifications for Corrosion-Resisting Chromium and Chromium-nickel Steel Welding Electrodes has been issued as a 13-page booklet. Patterned after the tentative specifications for iron and steel arc-welding electrodes for mild and low-alloy steel electrodes, it provides classification and test requirements for 24 classifications of electrodes. Copies at 25 cents each may be obtained from the American Welding Society, 33 W. 39th St., New York 18, N. Y., or the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

# How to beat the rust problem —at LOW COST



There is more than one answer to the problem of corrosion in ductwork. But considering cost of materials and their workability, there is a practical solution in the use of a rust-defying, copper-bearing galvanized sheet steel like Beth-Cu-Loy.

Beth-Cu-Loy Sheets offer a double defense against rust. Beth-Cu-Loy is protected on the surface by Prime Western zinc applied in a tight, bright coating. Under the coating is the Beth-Cu-Loy base containing 0.20 to 0.30 percent copper, with 2 to 2½ times the rust-resistance of ordinary steel. Result: if rust eventually penetrates the zinc coating, it comes up against a barrier of copper-bearing steel.

Beth-Cu-Loy sheets have the easy-forming qualities that sheet-metal men like, yet they have adequate stiffness to permit the use of long sections in ductwork. They are simple to cut, to seam and to solder. With all of these advantages, Beth-Cu-Loy Galvanized Sheets cost very little more than ordinary zinc-coated steel sheets.

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*On the Pacific Coast Bethlehem Products are sold by Bethlehem Pacific Coast Steel Corporation*

## Beth-Cu-Loy Galvanized Sheets

BETHLEHEM STEEL

DOMESTIC HOT WATER SERVICE FROM GAS-FIRED BOILERS—the American Gas Association Testing Laboratories has issued Research Report No. 1060-B on Field Study of Domestic Hot Water Service from Gas-Fired Boilers as the result of field studies. The report describes the various types of gas-fired boilers used for central heating systems which have been interconnected with domestic hot water systems to supply year-round hot water service. Costs of heating water during summer months with summer-winter hookups and with separate water heaters are reported from the records of interested gas companies. Price of this 15-page report is 75 cents and a copy may be obtained by writing American Gas Association Testing Laboratories, Cleveland, Ohio.

MINERAL WOOL INSULATION—Federal Specifications HH-1-564 has been issued to control the purchase of block and board forms of mineral wool insulation by the Army, Navy and Maritime Commission. These specifications may also be helpful to private purchasers, and those interested can obtain a copy of these specifications by writing to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The price is 5 cents per copy.

BRASS PIPE HANDBOOK—Many new features have been added to the third edition of this handbook published by Copper & Brass Research Association, 420 Lexington Ave., New York 17, N. Y. Written by T. N. Thomson, it is designed as a plumbing and heating handbook for the architect, engineer and contractor. It contains 56 pages of text and 16 pages of blueprints showing details of specific installations, both domestic and large buildings. For a copy write to the association at the address given.

FUEL, POWER AND STEAM COSTS—In an effort to help engineers establish the costs of fuel, power and steam in their respective plants, the Ministry of Fuel and Power has issued Fuel Efficiency Bulletin No. 48 on Fuel, Power and Heat Costing. It is a 38-page booklet that discusses the various components that enter the cost picture of these items. Included is a table to show practical examples of steam costs, and illustrative cost problems. For a free copy write to Ministry of Fuel and Power, Queen Anne's Chambers, Dean Farrar St., Westminster, England.

RESEARCH FACILITIES IN NEW YORK STATE—Booklet of 80 pages which for the first time lists the research laboratories and other technical facilities available to industries. Booklet lists sources of technical assistance, specialized personnel and unusual equipment which may be utilized by industries in the state. For a free copy of Directory of Research and Development Facilities at Educational Institutions in New York States write to the New York State Department of Commerce, 112 State St., Albany 7, N. Y.

# NEW CATALOGS

### Totally Enclosed Motors

The advantages of totally-enclosed motors, of both the fan-cooled and the non-ventilated type for application to machine tools, are described and illustrated in a new eight-page bulletin, NU-25A.—*Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo.* .....275

### Safety and Health Standards

A 20-page booklet contains a list of approximately 200 standards covering safety and industrial health, with brief descriptions of each standard.—*American Standards Association, 70 East 45th St., New York 17, N. Y.* .....276

### Axial Flow Fans

Propellair axial flow fans and ventilating equipment are described in a 68-page bound catalog, No. 12, including performance curves, engineering data, air duct friction chart, conversion tables, and dust collecting data.—*Propellair Div. of Robbins & Myers, Inc., Springfield, Ohio.* .....277

### Adjustable Tee

The Thrush Adjustaflo single main system of forced hot water heat, incorporating the new Thrush adjustable tee, is described in a 4-page bulletin. This tee allows for proportional distribution between main and riser, and the amount of flow in each direction is adjustable from the side of the tee by finger control of a swiveled deflector.—*H. A. Thrush & Co., Peru, Indiana.* .....278

### Mixed Flow Pumps

A mixed flow type pump, which can be applied to numerous dewatering, flood control, agricultural and industrial services, is described in a 24-page bulletin for applications requiring capacities up to 220,000 gpm. Pumps embody essential characteristics of both centrifugal and axial flow pumps.—*Peerless Pump Div., Food Machinery Corp., 301 W. Avenue 26, Los Angeles 31, Calif.* .....279

### Fan Data

Bulletin 471 covers type ME centrifugal fans with engineering notes, and has been prepared to aid those interested in the proper selection of centrifugal fans. The bulletin contains general, useful, engineering data including characteristic curves, volume tables, friction charts, etc., and engineers are invited to submit particular problems to the New York Blower engineering representative.—*The New York Blower Co., 32nd St., and Shields Ave., Chicago 16, Ill.* .....280

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Many foremost manufacturers, having discovered our specialized skill in our particular line, have entrusted us with a great variety of precision pipe and tube work, including bending, coiling, expanding, flattening, brazing and welding.

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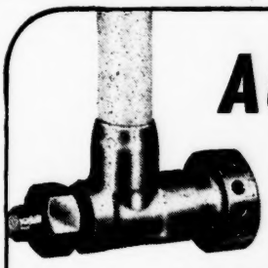
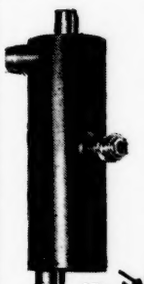


**Automatic Liquid Feed without Moving Parts**

Injector with Distributor Head



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Adaptable to "Freon" applications, from air conditioning and water chilling to cold storage installations with plate coils, fin coils, and unit coolers. Injector capacities from fractional to 200 tons with "Freon." Furnished with either single outlet or distributor head.

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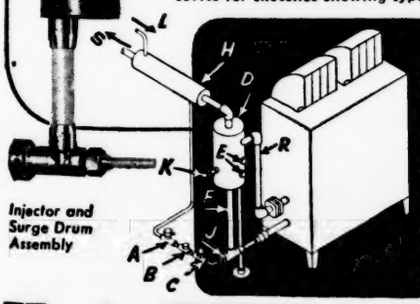


Injector and Surge Drum Assembly

FLOOR TYPE ROOM COOLER HOOK-UP
A—MAGNETIC SOLENOID
B—BULLS-EYE
C—HAND VALVE
D—SURGE DRUM
E—SIGHT GLASSES
F—LIQUID LEG
H—HEAT EXCHANGER
J—INJECTOR
K—CHARGING CONNECTION
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R—GAS RETURN
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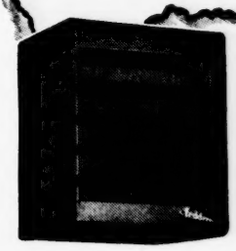

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The men who represent Fedders are qualified to aid in selecting the proper size and type of Horizontal and Downblow Unit Heaters to fit every installation.

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### Controls

Catalog No. 8302, "Industrial Control Devices," contains information on electrical and pneumatic automatic control systems. Schematic diagrams, dimensional drawings of instruments, with specifications, range of charts, etc. cover temperature pressure and humidity controls, engine cutouts, float switches, relays, etc.—*The Brown Instrument Co., Division of Minneapolis-Honeywell Regulator Co., Wayne and Roberts Ave., Philadelphia 44, Pa.* .....281

### Water Conditioning

Cochrane publication No. 4021, describes carbonaceous zeolite water conditioning equipment for softening boiler feed and industrial process waters. This is a revised edition of this publication.—*Cochrane Corp., 17th St., & Allegheny Ave., Philadelphia 32, Pa.* .....282

### V-Belt Pulley

A 4-page booklet gives construction and application details on the new Spiralok fixed adjustable V-belt pulley.—*Scientiae Corporation, 101 Pine Street, Dayton 2, Ohio.* .....283

### Fans

A 28-page catalog gives design and construction specifications with complete performance data on the various types of desk fans, air circulators, ceiling fans, kitchen ventilators, exhaust and cooler fans. Included is detailed dimensional information for Emerson-Electric exhaust and ventilating fans and accessories.—*Emerson Electric Mfg. Co., St. Louis, Mo.* .....284

### Air Conditioning Products

Products used in the heating, ventilating and air conditioning field in a variety of installations from department stores and office buildings to aviation welding tools are presented in a 12-page bulletin, No. 25B6183. Equipment includes V-belt drives, centrifugal pumps, motors, motor controls, transformers, and welders.—*Allis-Chalmers Mfg. Co., 1126 S. 70th Street, Milwaukee 1, Wis.* .....285

### Refrigeration Valves and Strainers

Catalog No. 200 describes thermal expansion valves for various refrigeration applications with drawings, sizing charts and selection data. Also described are magnetic, liquid, and suction stop valves. — *General Controls, 801 Allen Ave., Glendale 1, Calif.* .....286

### Insulating Felt

Bulletin 300, 4 pages, 2 colors, gives specifications and pertinent data on Ozite insulating felt.—*American Hair and Felt Co., 222 N. Bank Drive, Chicago 54, Ill.* .....287

### Stokers

Bulletin No. S-32 describes types LR and LRI Ram-Feed Stokers with capacities of 75 to 315 boiler hp. Two outstanding features are automatic air volume control and intermittent coal feed control. — *The Brownell Company, 410 North Findlay St., Dayton 1, Ohio*.....288

### Flexible Metal Hose

Catalog G-47 introduces the term *Flexonics*, defined as the science of controlled bending of thin metals for use under various conditions in temperature, pressure, vibration and corrosion. Separate sections of the catalog are devoted to various types of metal hose.—*Chicago Metal Hose Corp., Maywood, Ill.* .....289

### Condensation Return Units

A complete line of condensation return units and boiler feed pumps is illustrated in a 24-page bulletin, No. CR-1. Bulletin includes selection tables which list for varying areas of radiation the rated amount of condensation produced and the equivalent boiler horsepower; the boiler pressure against which the unit is to operate; the equivalent pounds per square inch pressure between the boiler water level and the pump; and other factors essential in the proper selection of the unit.—*The Deming Co., Salem, Ohio.* .....290

### Speed Selector

A broadside on the new improved Variable-V-Planetary infinite ratio speed selector recently announced jointly by Speed Selector, Inc., Cleveland, Ohio, and The B. F. Goodrich Company, Akron, Ohio, describes construction of the speed selector, which employs planetary motion with four variable pitch sheaves and two standard cross section V-belts to provide any speed from zero to 800 r.p.m. at constant torque from a constant speed power source.—*The B. F. Goodrich Co., Akron, Ohio.* .....291

### Prefabricated Insulated Pipe

Designed for practical use of engineers and architects, is a booklet of specifications for underground pipe distribution systems employing prefabricated insulated pipe conduit. Data is arranged in tabular form with supplementary diagrams and charts. Tables include dimensions for one or more conduits in one trench, maximum capacities, expansion loop details, etc.—*The Ric-wiL Co., Cleveland, Ohio.* .....292

### Packaged Resistance Welding Control

Synchro-trol, a new line of synchronous-precision, a-c resistance welding controls in a complete factory-assembled package, is described in an 18-page illustrated booklet (B-3839). Designers of resistance welding products select component units for production requirements. Charts show how these units and sub units are assembled to form various standard packages. —*Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.* .....293

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**Offer You These Four Advantages**

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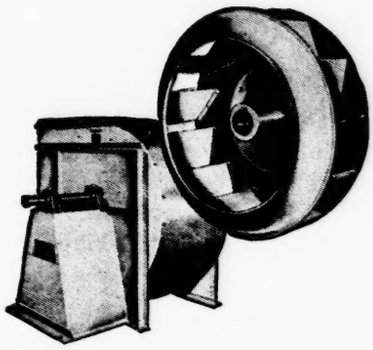

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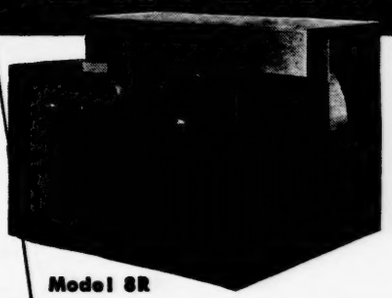


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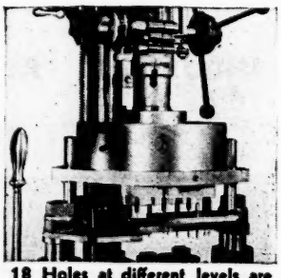

18 Holes at different levels are simultaneously drilled by this standard Zagar Drillhead adapted to a 17" Delta drill press.

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### V-Belts

The new Veelos V-Belt, a link arrangement adjustable to any length and adaptable to any drive, is described in a new 24-page catalog with installation photographs, sizing and rating data, and construction characteristics. Veelos is available for drives from ¼ to 1000 hp.—*Manheim Manufacturing & Belting Co., Manheim, Pa.* .....294

### Testing Facilities

Heating, ventilating and air conditioning laboratory testing facilities are described in a 4-page bulletin.—*U. S. Testing Co., Inc., Hoboken, N. J.* .....295

### Motor Controls

A four-page folder, No. 4705, describes Master AC magnetic across-the-line motor starters. Cutaway diagrams show construction details on starters for both built-in and remote control. — *The Master Electric Company, Dayton 1, Ohio.* .....296

### Unit Steam Generators

A two-color, eight-page bulletin, No. 1000E, describing in detail Preferred unit steam generators covers self-contained, oil-fired, steam generating plants of 4-pass, induced-draft construction, ranging in size from 40 to 500 hp. They operate fully automatically even on heavy oil with minimum guaranteed thermal efficiencies of 80%.—*Preferred Utilities Mfg. Corp., 1860 Broadway, New York 23, N. Y.* .....297

### Expansion Joints

A new eight-page illustrated booklet No. 35-30D, covers Adsco internally guided expansion joints for steam, water, oil and other pipe lines with construction details, dimensions, and list prices in sizes ranging from 1¼ in. to 20 in. for working pressures up to 300 lb.—*American District Steam Co., North Tonawanda, N. Y.* .....298

### Refrigerant Valves and Fittings

Catalog No. 46 is a loose leaf assembly of bulletins covering valves and fittings especially designed for refrigeration installations. Thermostatic expansion valves for various types of refrigerants are pictured and described with sizing and operation tables, refrigerant distributors, pilot controls, solenoid valves, strainers, and dehydrators are described with sizing and installation data.—*Sporlan Valve Co., 3723 Commonwealth Ave., St. Louis 17, Mo.* .....299

### Water Hammer Control

Sealed air chambers for water hammer control designed for specific installation conditions are described with selector tables and installation instructions in Bulletin No. 120. — *Wade Manufacturing Company, Elgin, Ill.* .....300

### Deaerators

Design features, application photographs, and special equipment for boiler water conditioning are the subjects of a 30-page catalog covering Cochrane deaerators.—*Cochrane Corp., 17th St., and Allegheny Ave., Philadelphia 32, Pa.* .....301

### Steam Specialties

A four-page bulletin No. 715, shows representative type of steam traps, separators and boiler trimmings. Brief descriptions of 22 products are included.—*Wright-Austin Co., 315 W. Woodbridge St., Detroit 26, Mich.* .....302

### Acetylene Generators and Manifolds

A new 22-page two-purpose catalog lists and explains the complete line of Airco acetylene generators, both stationary and portable. Generators covered are the 300 lb, both single and double rated and the 500 lb double rated. Portable generators range in size from 15 to 50 lb. Second part of the catalog covers Airco manifolds for both oxygen and acetylene.—*Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.* .....303

### Thermostatic Switches

Thermoswitch controls for heat control and temperature detection are described in a four-color catalog showing a line of thermally activated switches and presenting the necessary data for their selection and application.—*Fenwal, Inc., Ashland, Mass.* .....304

### Hay Drying Fans

The Macheta Aerovent airfoil fan as applied to drying systems for the mow-curing of hay, are described in a four-page bulletin.—*Aerovent Fan Co., Agricultural Div., 818 N. Jenison Ave., P. O. Box 636, Lansing 3, Mich.* .....305

JUNE, 1947

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**Editor, HEATING AND VENTILATING,**
**148 Lafayette Street, New York 13, N. Y.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 |
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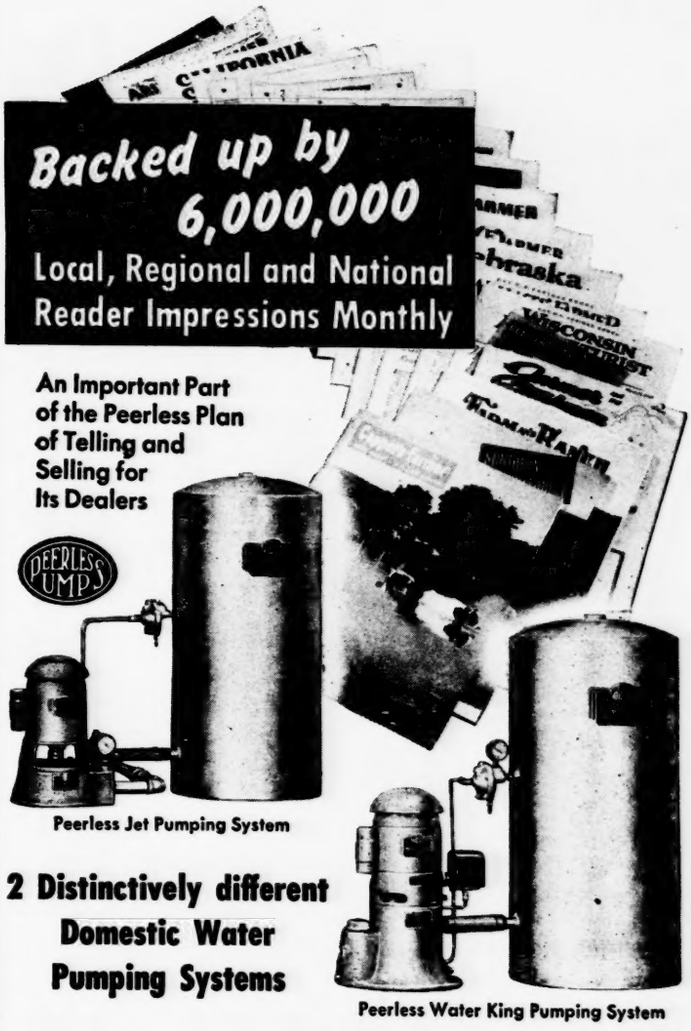
Backed up by
6,000,000
Local, Regional and National
Reader Impressions Monthly
An Important Part of the Peerless Plan of Telling and Selling for Its Dealers
PEERLESS PUMPS
Peerless Jet Pumping System
2 Distinctively different Domestic Water Pumping Systems
Peerless Water King Pumping System

## Take the Armwork out of Farmwork and Put Profit Dollars in the Dealer's Pocket!

Enabling its dealers to more completely fill the needs of any domestic water system installation, the Peerless Water King and Peerless Jet Pumps have been designed to cover the entire range of customer requirements for a dependable, economical source of water. Take the Peerless Water King for example. Here is a pump that is entirely unique in its principle of operation. Only Peerless dealers can offer its exclusive advantages for shallow well pump installation. The Water King's exceptional performance offers an automatic, constant pressure water supply from 275 to 860 G.P.Hr. from well depths to 20 feet. Easy to understand and economical to operate.

For installations requiring capacities of 120 to 7500 G.P.Hr., from well depths to 120 feet, the Peerless Jet Water System would be most practical. This advanced Jet system utilizes an entirely automatic principle of applied pressure. Precision-built and extremely simple in design for a lifetime of trouble free water service at minimum cost. Both Peerless water systems may be easily installed over well or offset.

Take advantage of the business opportunities offered Peerless dealers. Plan with Peerless! Write today for the FACTS!

**PEERLESS PUMP DIVISION**
FOOD MACHINERY CORPORATION
Factories: Canton 6, Ohio • Quincy, Illinois • Los Angeles 31, California
District Offices:
Canton 2, Ohio, Philadelphia: Suburban Square, Ardmore, Pa.
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Kling
ROTARY SHEARS
DO MANY TYPES OF WORK
DOES ALL THIS WORK FOR YOU
1 CUTS STRAIGHT LINES
2 CUTS RINGS-SMALL OR LARGE RADII
3 CUTS CIRCLES
4 MAKES FLANGES
5 CUTS INSIDE HOLES WITHOUT CUTTING IN FROM EDGES
6 JOGGLES & OFFSETS
7 CUTS ODD SHAPES
8 BEVELS OF ANY ANGLE
9 CUTS REVERSE CURVES
10 BEADS & U'S
ALL WITH Hairline PRECISION

## *Yes, and With Hairline Precision*

**Rapid operation . . . Hairline Accuracy . . . the use of Kling Rotary Shears marks the latest development in cutting mild steel, and sheet metal, up to 1-inch with amazing savings in time, labor, and production costs.**

**For exacting projects (see illustration at the right), no single unit of metal-working equipment does so many different things so cleanly and efficiently as does the Kling Rotary, pictured above.**

**In metal-working plants, automotive, aviation, home appliance, and other industries, where work of this character is being done,—this machine is held in high regard for its versatility and economy of operation.**

**This great usefulness is the result of half-a-hundred years of engineering experience which prospective buyers, with reason and respect, applaud.**

**Send Today for Bulletin No. 245** which will give you specific facts, and specifications. No obligatoin involved. Users of heavy equipment of Kling Rotary Shears' class will receive a copy of this Bulletin promptly, on request.

**KLING BROS. *Engineering Works***

**1322-HV No. Kostner Ave., Chicago 51, Illinois**

*EXPORT DEPT. 1111 South Ferry Building, New York 4, N. Y.*


# WHAT READERS SAY

### Are We Ready for Annual Shows?

Many letters were received, mostly from manufacturers serving the heating, ventilating and air conditioning fields, commenting on the editorial "Are We Ready for Annual Shows?" that was published in the April issue. With the exception of one letter, all the readers stated they were definitely opposed to the holding of annual heating and ventilating shows. Because of space limitations, excerpts can be printed from only some of these letters.

"As an exhibitor at the Cleveland show in 1947 and the proposed show in 1948, we feel that annual shows work a hardship on the manufacturer. Models within the heating industry do not change so rapidly as to require an annual show."—*Heater Manufacturer.*

"At the present time our entire product is oil burning heating equipment . . . We must support the shows of the Oil Heat Institute . . . I think that many other manufacturers will find that they will have to adopt this policy."—*Oil Burner Manufacturer.*

"Granted that expositions are to produce sales and granted that they do and have done some good, they can be overdone as a means of selling . . . I do think that it is profitable to exhibit biennially and in some cases, depending on the nature of the exposition and industry, every three years. Between such periods, there is more time for development and preparation."—*Control Manufacturer.*

"We really feel that the pre-war arrangement of having the Heating and Ventilating Show every two years, and then having the Oil Burner Show the other year is best. It is too much of a burden financially to exhibit in two or more shows per year, and particularly at the present time, it is a very heavy burden from a time standpoint. We have decided not to exhibit at the 1948 show although we are a regular exhibitor."—*Oil Burner Manufacturer.*

"If the heating and ventilating exposition becomes an annual affair, in our opinion one of two things is liable to happen. The specialized industries will be forced into an annual basis and the possible result will be that the heating and ventilating exposition instead of representing the broad, cross section which it has in the past, will become merely a show for the types of equipment they do not fit into—for example, the gas field, the oil burner field, the stoker field, warm air field, etc. . . . We have determined that should the exposition be held annually, we will exhibit biennially, showing during the alternate years at the more specialized exhibitions."—*Control Manufacturer.*

"In my discussion with many manufacturers of boilers, automatic heating equipment, oil burners and automatic electric controls, as well as manufacturers of other items used in heating systems, they feel that annual national shows of all the various associations could develop into a real hardship for them. . . . It certainly would seem advisable for all of the interested parties to work out some sort of a schedule that would reduce the hardship that is created for the manufacturers."—*Association.*

"We are all in favor of it. This show is of great value to us. Our device is relatively new to the industry and this show gives us a good chance to present it to a large and important section of the industry."—*Control Manufacturer.*

"We express our appreciation of the careful analysis of the situation in your editorial. Our company does not believe it will be profitable in years to come to exhibit at all the shows being planned."—*Manufacturer.*

"We feel that the expenditure every year is questionable when plotted against sales results.... It is not always possible for a manufacturer to fail to participate. That is because of both competition and the dealer organization. We are in the position of being forced into an exhibit against our better judgment."—*Air Filter Manufacturer.*

"An exposition is but one means of advertising a product.... If we listen to the promoters of expositions, we get the impression that you can't properly introduce a product or obtain the benefits from advertising unless that particular product is displayed at an exposition."—*Association.*

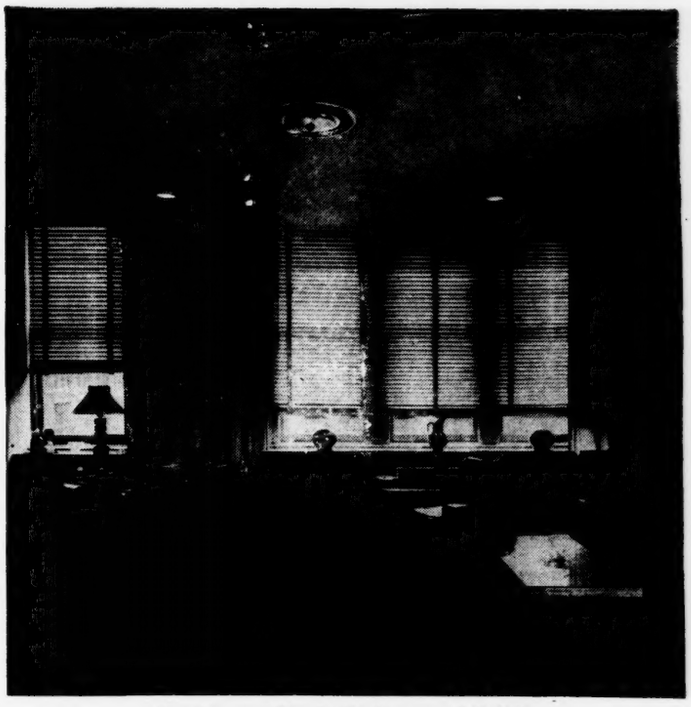
"Too many shows—too much time and cost—too little change to justify it. Let's work for bread and butter, not dessert, for a while. Do all you can to discourage annual shows.—*Pipe Manufacturer.*

"As I read your thinking from this editorial, I go along with it. Exhibiting in the alternate year shows sponsored by the ASH & VE has been as encumbent upon a self-respecting firm in the heating business, as possessing a Sunday suit of clothes has been traditionally expected of a male citizen of good repute. In both cases the standard was met even if the times were difficult."—*Heater Manufacturer.*

"You stated our problem very clearly and if anything you lean to moderation in stating it.... Fundamentally, it would seem to me from a purely personal viewpoint that the ultimate solution of this thing is in the hands of the manufacturers. If enough of them refuse to support two shows annually, there will probably not be two shows annually for very many years." *Oil Burner Manufacturer.*

"I don't think we are ready... we have refused to participate (in annual shows). We don't feel the expense, plus the time required by our entire staff, justifies the end.... Because we must display at the All Industry Refrigeration and Air Conditioning Show in January, there is not enough time to move from that show in Cleveland to the Heating and Ventilating Show in New York without a separate display. In addition, our people would be kept from their work for two weeks. We feel the show should be every other year and that it should alternate with REMA." —*Control Manufacturer.*

"In our opinion, an oil burner show one year and a heating and ventilating show the next is the ideal arrangement. This gives the industry one specialized show and one general show, alternate years. We meet many people and pick up some business at heating and ventilating shows but not enough to justify the expense in addition to the oil burner show."—*Coupling Manufacturer.*

*Sheehan and Krech, Designers and Builders*
*Air Conditioning by Schwerin Air Conditioning Corporation*

# Simply designed air diffuser blends with interior

**Provides complete air conditioning comfort by eliminating drafts, noise, hot or cold spots.**

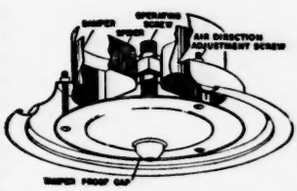
**In addition to their unobtrusive appearance, Kno-Draft Adjustable Air Diffusers are specified for installations like the one pictured here in the offices of Schwarzenbach-Huber Co. because they combine all the advantages of scientific air diffusion plus adjustable features which assure positive air pattern control.**

**Kno-Draft adjustability increases efficiency and economy.**

Diffusers improve occupant comfort by delivering conditioned air gently and thoroughly. Drafts and noise so often experienced with grilles, registers and other louvered devices are eliminated. Economy is increased. Diffusers handle greater air velocities and greater temperature differentials. This means less air volume, smaller, simpler ducts and fewer outlets.

To those advantages, Kno-Draft adds adjustment features that increase both the efficiency and economy of the air diffusion principle and a simplicity of design that blends with any interior.

***Kno-Draft Direction Adjustment assures positive air pattern control by affording any angle of air discharge from vertical to horizontal that is needed to accommodate ceiling heights, individual or seasonal requirements. Volume adjustment is made with a patented damper that regulates the amount of air without affecting the velocity or diffusion pattern.***




*Pat. & Pat. Pending*

Send for FREE handbook that simplifies the selection and installation of diffusers. Write Dept. E-14 on your letterhead.

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**AIR DIFFUSION AIR PURIFICATION AIR RECOVERY**
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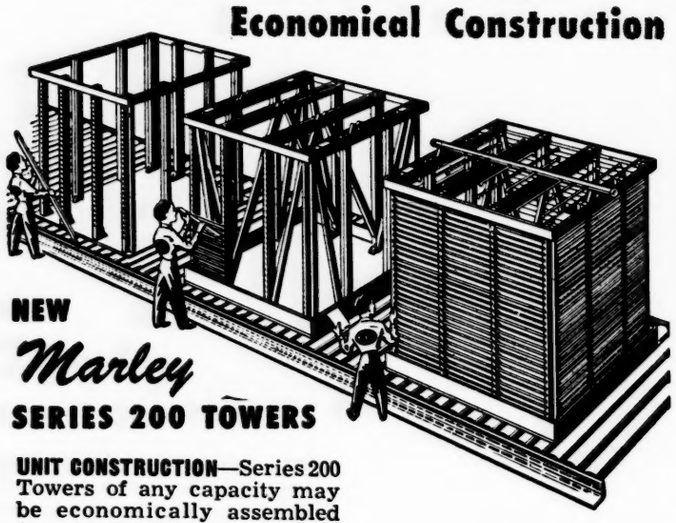
IN CANADA: Douglas Engineering Co., Ltd., 1405 Bishop St., Montreal 25, P.Q.

NOW THEY'RE *Standardized*
for Volume Production
Economical Construction



NEW
*Marley*
SERIES 200 TOWERS

**UNIT CONSTRUCTION**—Series 200 Towers of any capacity may be economically assembled from standard parts.

**ADDED STRENGTH**—Series 200 Towers are framed structurally complete before louver posts and louvers are added. Completely shop fabricated.

**SPRACOIL COOLING**—Series 200 Towers, without alteration, are adaptable for closed system cooling; utilize Marley Spracoils. Request Bulletin 200B-47

MARLEY PATENTED SPRAY NOZZLES are standard equipment in all Marley Atmospheric Towers.

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

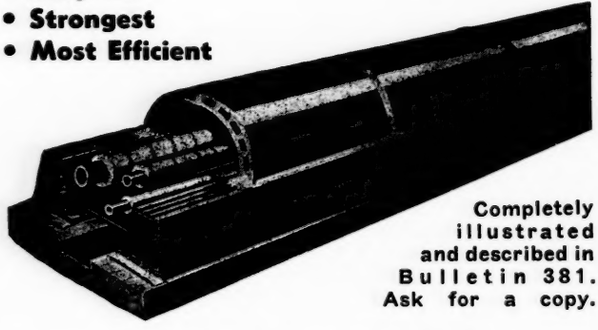
**The BEST Underground Pipe Conduit**

. . . is the one that is **lowest in final cost** – NOT the one that is lowest in first cost.

**THERM-O-TILE**
Reg. U. S. Pat. Off.

Not only is Therm-O-Tile **lowest in final cost** – it is **competitive** even in first cost.

- **Simplest**
- **Strongest**
- **Most Efficient**



Completely illustrated and described in Bulletin 381. Ask for a copy.

*Sold and installed by Johns-Manville Construction Units in all principal cities.*

**H. W. PORTER & CO., Inc.**
823-V Frelinghuysen Ave. Newark 5, N. J.

## INDUSTRIAL DEGREE-DAYS
April, 1947

| City | 55F Base | 45F Base |
|---|---|---|
| Baltimore, Md. | 79 | 2 |
| Buffalo, N. Y. | 367 | 131 |
| Chicago, Ill. | 265 | 62 |
| Cleveland, Ohio | 282 | 70 |
| Detroit, Mich. | 326 | 101 |
| Indianapolis, Ind. | 143 | 16 |
| New York, N. Y. | 186 | 22 |
| Philadelphia, Pa. | 110 | 6 |
| Pittsburgh, Pa. | 152 | 9 |
| St. Louis, Mo. | 76 | 1 |

## CANADIAN DEGREE-DAYS FOR APRIL, 1947*

| City | April 1947 | April Normal | Cumulative, Sept. 1 to April 30 1946-47 | Cumulative, Sept. 1 to April 30 Normal |
|---|---|---|---|---|
| Calgary, Alta. | 693 | 750 | 8972 | 8631 |
| Charlottetown, P. E. I. | 909 | 858 | 7294 | 7727 |
| Crescent Valley, B. C. | 558 | 624 | 6987 | 7328 |
| Edmonton, Alta. | 768 | 780 | 10,082 | 9369 |
| Fort William, Ont. | 993 | 888 | 9508 | 9478 |
| Grande Prairie, Alta. | 810 | 822 | 10,550 | 9617 |
| Halifax, N. S. | 801 | 768 | 6412 | 6902 |
| London, Ont. | 720 | 642 | 6766 | 6968 |
| Medicine Hat, Alta. | 609 | 606 | 8929 | 8194 |
| Moncton, N. B. | 906 | 798 | 7674 | 8094 |
| Montreal, P. Q. | 819 | 715 | 7728 | 8088 |
| North Bay, Ont. | 984 | 813 | 8967 | 8746 |
| Ottawa, Ont. | 843 | 726 | 8114 | 8364 |
| Penticton, B. C. | 465 | 507 | 6229 | 6073 |
| Porquis Junction, Ont. | 1230 | 972 | 10,219 | 10,586 |
| Prince George, B. C. | 687 | 738 | 8725 | 8506 |
| Quebec City, P. Q. | 978 | 849 | 8236 | 8848 |
| Regina, Sask. | 828 | 816 | 10,932 | 10,457 |
| St. John, N. B. | 840 | 792 | 6945 | 7576 |
| Saskatoon, Sask. | 831 | 725 | 11,106 | 10,081 |
| Toronto, Ont. | 683 | 669 | 6335 | 6895 |
| Vancouver, B. C. | 444 | 498 | 5160 | 4977 |
| Victoria, B. C. | 420 | 504 | 4591 | 4569 |
| Windsor, Ont. | 624 | 582 | 6100 | 6454 |
| Winnipeg, Man. | 888 | 822 | 10,404 | 10,444 |

*These data are supplied through the courtesy of the Meteorological Division, Air Services Branch, Department of Transport, Canada, with the cooperation of N. W. Etter, Heating Engineer, Enamel & Heating Products Limited, Sackville, N. B.

The Department reports a slight revision in figures for March as published in last month's issue. Corrected figures are: Montreal, P. Q., 1129; Penticton, B. C., 756.

## . . . Since the Last Issue

Stockholders of **United States Radiator Corp.** at their annual meeting reelected the board of directors and added **Walter D. Binger,** New York, to the board. Mr. Binger is a vice-president of City Investing Co., one of the largest owners of New York City real estate and properties.

**Ladish Co. of Cudahy,** Wisconsin announces the appointment of **H. L. Pehrson** as manager of West Coast sales of Ladish pipe fittings with offices at 714 West Olympic Boulevard, Los Angeles 15, Calif.

**Robert T. Killian** has been appointed manager of market development and research by the **Bryant Heater Co.** of Cleveland. Mr. Killian comes to Bryant from the Westinghouse Electric Corp., where he was manager of the product and industry section of the market development department. Previous to that connection, he was manager of the sales analysis section of the U. S. Steel Corp. Bryant also announces the opening of a new branch office in Cleveland with **Phil D. Bertholf** as manager. The new branch office will handle distribution of Bryant products for the Northeastern Ohio area.

*R. T. Killian*

**Robert M. Balch, Jr.**, has been named supervisor of hotel control sales for the **Minneapolis-Honeywell Regulator Co.** Mr. Balch attended the University of Minnesota and has been associated with the Airtemp division of the Chrysler Corporation. He first joined Honeywell in 1936 and worked in various sales capacities, including sales managership of the apartment controls division, until his most recent promotion.

**B. C. Benson** has been named supervisor of hospital-control sales for Minneapolis-Honeywell. Mr. Benson is a professional engineer, attended the Armour Institute, Chicago, and has been employed in the mechanical engineering departments of the Austin Company, Cleveland, and Dodge Chicago plant. He joined Minneapolis-Honeywell in 1943 and, until his latest promotion, was Chicago zone sales supervisor for the company's apartment controls division.

The election of **Howard M. Dirks** as vice-president and personnel director of **Carrier Corp.**, manufacturer of air conditioning and refrigeration equipment, has been announced. Mr. Dirks has resigned his position as director of industrial relations of the Perfect Circle Corp. of Hagerstown, Indiana, in order to take up his duties in Syracuse on May 1.

**William L. Melcher**, product service supervisor at the Milwaukee headquarters of the **A. O. Smith Corp.**, has been transferred to New Orleans where he will be in charge of the company's water heater and conversion burner sales in the states of Louisiana and Arkansas. This area is controlled by the company's district office at Houston, Texas.

**Jack York Hewitt** has been named sales manager of both the Miracula (heat pump) and Gemco Air Conditioner Divisions of the **General Engineering and Manufacturing Co.**, of St. Louis. Mr. Hewitt formerly was sales manager of the air conditioner division only.

*J. Y. Hewitt*

Also announced was the appointment of **Frank D. Klein** as assistant sales manager of the air conditioner division. Mr. Klein was previously production manager of the Murray Corp. plant in Detroit, and assistant factory manager of the Consolidated Vultee plant in Nashville.

Newly appointed Canadian representative of the **Automatic Products Co.** of Milwaukee, Wis., is **J. E. Hutchinson** of Brantford, Ontario.


**Self-Cleaning Feature of**

**DEPENDABLE**

**Water Regulating Valve**

**. . . MEANS "TROUBLE-FREE" ACCURACY AND LONGER SERVICE**

**You'll avoid trouble—**

due to dirt and lime in your water when you install the new A-P Model 68-B Water Regulating Valve on your water-cooled condensing units. A radically different construction principle actually "cleans itself," employing a molded composition seal on the valve stem which moves across the polished mirror-smooth stainless steel seat with an effective "wiping" action. Laboratory tested in sandy water, this unique sliding seal and seat showed no sign of water after the equivalent of many years use — proof of "lifetime" of accurate water regulating service.

With an operating head pressure of 50 to 150 p.s.i. Model 68-B can be easily adjusted to your system through the wide port in the body. Its long stroke provides closer, more uniform control without chattering or water-hammer. Three sizes, ⅜", ½" and ¾" inlet and outlet, offer a wide range of utility on Freon, Methyl Chloride or Sulphur Dioxide systems. Buy it today at your leading Refrigeration Jobbers — or write for bulletin No. M100.

**DEPENDABLE** Refrigeration Valves include: Thermostatic Expansion Valves, Refrigerant and Water Solenoids, Suction Pressure Regulating Valves, "Trap-Dri" Drier-Filter-Strainer and "Trap-It" Filter-Strainer, and Thermostats for cooling or heating.

**AUTOMATIC PRODUCTS COMPANY**

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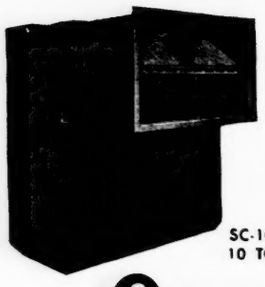
**DEPENDABLE**

REFRIGERANT VALVES

FOR AIR CONDITIONING • REFRIGERATION • HEATING

Combination FOR Comfort — TEMPERATURE plus HUMIDITY CONTROL

**1 ROGERS SELF-CONTAINED AIR CONDITIONING UNIT**



For contractors and owners who want better performance, longer life and more uniform satisfaction. ROGERS Conditioners are noise-proofed, vibration dampened. Large filter and coil area, rugged construction and economical operation. Require minimum floor space. HEATING COIL AND HUMIDIFIER EASILY INSTALLED FOR YEAR ROUND CONDITIONING.

SC-1000
10 TON UNIT

**2 ROGERS SYSTEM OF CHEMICAL DEHUMIDIFICATION WITH TEG**

A most efficient unit using triethylene glycol (TEG) as dehumidifying agent and for sterilization of air. Gives automatic, *complete and independent control of temperature and humidity* when used with ROGERS conditioners. Can be used separately where dehumidifying only is wanted. Particularly useful in industrial processing or where accurately controlled humidity is desirable. Easy to install.

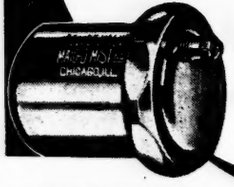
WIDE RANGE OF SIZES
IMMEDIATE SHIPMENT ON MOST MODELS

R. B. ROGERS COMPANIES INC.
1120 LEGGETT AVE., NEW YORK 59, N. Y.
Manufacturers of Equipment for Air Conditioning, Refrigeration, Heating and Ventilation.

MANUFACTURERS OF COEY FLOATING FILM COOLING TOWER



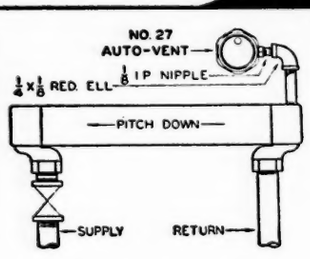
HOW TO GET **PERFECT CIRCULATION** in Hot Water Radiators and Convectors



**AUTO-VENT AIR ELIMINATORS REALLY DO A JOB!**

As air accumulates in radiators or pipes, it is AUTOMATICALLY VENTED when you use these inexpensive No. 27s. Your customer gets better heating and saves fuel.

AUTO-VENTS work equally well on convectors, baseboard radiation, panels, radiant heating coils, etc. — NO AIR CHAMBER REQUIRED. Good for pressures to 50 lbs. *See your jobber, or write us direct.*




**SIMPLE AS A-B-C**

Detailed drawing of No. 27 Auto-Vent Air Eliminator operating on convector radiator. Auto-Vents used on other types of jobs are just as easily installed — and no attention required.

MAID-O-MIST INC.
3227 N. PULASKI RD.
CHICAGO 41, ILLINOIS

AUTOMATIC HUMIDIFIERS FOR ALL TYPES OF HEATING SYSTEMS


**Viking Air Conditioning Corp.** of Cleveland, Ohio, manufacturers of furnace blowers and humidifiers has announced the advancement of **Malcolm F. Mackenzie,** their Michigan representative. Mr. Mackenzie has been put in charge of directing the sale of Viking blowers and humidifiers in the entire North Central section. This includes the states of Michigan, Wisconson, Minnesota, and the northern portions of Indiana, Illinois and Iowa.

**The Trane Co.,** La Crosse, Wisconsin, manufacturers of heating, cooling and air conditioning equipment, announce the appointment of **Ralph E. Lee** as manager of the Unit Heater Sales Department. **A. H. Kaulfuss,** long an engineer in the department, has been named assistant manager. Mr. Lee has been export director of Trane since 1945, establishing sales connections in all parts of the world, principally in the South American countries. He has been affiliated with the company for 11 years, except for a 3½ year period as a pilot in the Army Air Corps. Prior to the war, he was an assistant in the advertising department and the steam specialties department. Succeeding Mr. Lee as export director is **E. R. Becraft** who joined The Trane Co. in 1937 as a sales engineer.

*R. E. Lee*

Resumption of its stoker export business after a five-year wartime lapse was announced by **U. S. Machine Corp.,** Lebanon, Indiana, manufacturers of Winkler stokers. Herman E. Winkler, executive vice-president, reported that first postwar shipments to foreign countries, which began in May, included 114 Winkler commercial stokers consigned to China, and 25 commercial and industrial models to Sweden.

**Charles B. Briggs, Jr.,** has been appointed production manager of the Kansas City, Kansas plant of **The Marley Co., Inc.,** manufacturers of cooling towers, nozzles and other water cooling equipment. Mr. Briggs, who has been with The Marley Company since September, 1944 as application engineer and Public Relations Director, succeeds E. A. Ostrom who is now manager of the Marley Stockton plant.

**Norbert Downey** has joined the staff of **McQuay, Inc.,** manufacturers of refrigeration and other air-conditioning equipment. For many years, Mr. Downey was advertising manager of the Trane Co., of La Crosse and for nine years headed that firm's industrial heating division and publicity department. At McQuay, Inc., Mr. Downey will be in charge of industrial unit heating sales.

**A. E. Whitehall** has been appointed national secretary of **the Distribution Division of Oil-Heat Institute of America.** Mr. Whitehall was formerly with the National Association of Manufacturers and the Manufacturers' Association of Connecticut. His previous activities were in public relations, advertising and merchandising fields and in sales administration with one of the major oil companies.

**Rutherford L. Stinard,** formerly with The Trane Co., has joined **The Tishman Realty and Construction Co.,** New York, and will be in charge of mechanical and electrical work.

**Pittsburgh Lectrodryer Corp.** announces that it has retained Professors **E. R. Queer** and **E. R. McLaughlin**, both of Pennsylvania State College, as consulting engineers in the fields of solid adsorption, dehumidification and allied fields.

**W. B. Connor Engineering Corp.**, manufacturers of Dorex activated carbon air recovery equipment and Kno-Draft adjustable air diffusers, announce that **Patrick J. Shea** has become associated with them. Mr. Shea was a member of the Carrier organization for eight years and was associated with Charles S. Leopold in the design of the air conditioning system of the Pentagon Building. He is expected to travel extensively in the promation of Dorex air recovery.

The entire facilities of the Combustion Equipment Division of **Todd Shipyards Corp.**, including machine shops, assembly shops, stores, service department, engineering department, drafting room and offices, moved May 1 from the Starrett-Lehigh Building at 601 West 26th Street, New York City, to a modern plant and office building at 81-16 45th Avenue, Elmhurst, Queens, New York. This Division of the Todd Corp. specializes in the design and manufacture of oil burning equipment for marine service, and in the design and manufacture of gas and oil burning equipment for commercial and industrial plants.

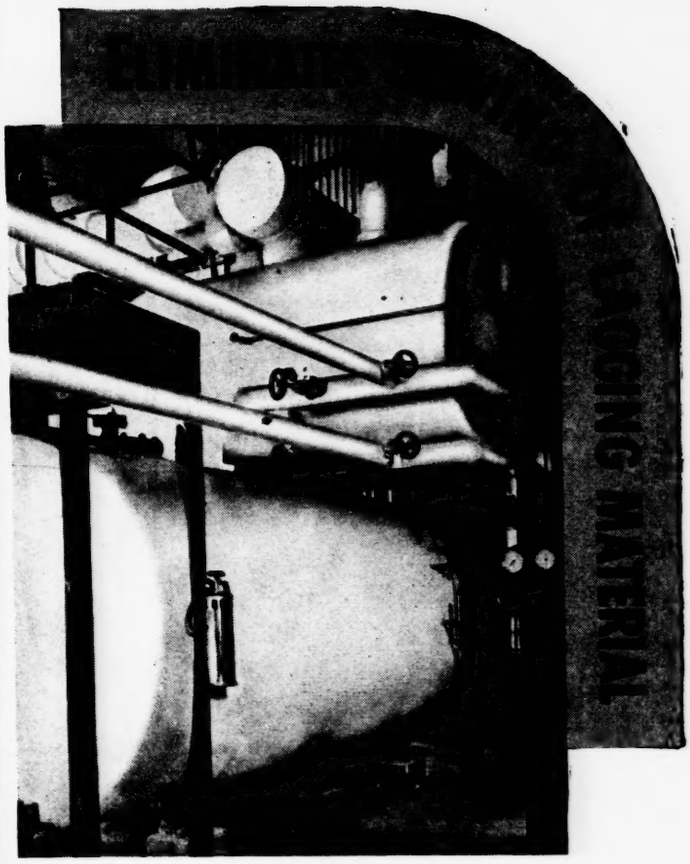
Effective April 1, 1947, the Chicago office of **Mehring & Hanson Co.**, including operations in the Middlewest, will be in charge of **H. C. Wyatt**, vice-president and **J. E. McClellan**, vice-president. Mr. Wyatt has been with the company for 12 years and has been an officer of the corporation for three years. Mr. McClellan has spent the past 28 years with the American Blower Co., the past 24 in Chicago and he has been district manager since 1930.

**Breeze Corporation, Inc.** of Newark, N. J. has acquired, for cash, all of the outstanding capital stock of the Aldrich Co. of Wyoming, Ill., manufacturer of oil burners and home heating equipment.

*P. K. Addams*

Homer Addams, chairman of the board of directors, **Fitzgibbons Boiler Co., Inc.**, New York, announced that at the annual meeting of the board of directors, his son, **Paul K. Addams**, was elected to succeed him as president. Homer Addams retains his position as chairman of the board. Other officers elected were **John A. Darts**, executive vice-president and **Ray C. Malvin**, vice-president. All other officers were re-elected to their respective positions. Paul K. Addams came to Fitzgibbons in 1929, after graduation from the Wharton School of Finance and Commerce, University of Pennsylvania in Philadelphia, Pa. Until 1931 he devoted his time to manufacturing activities and personnel relations at the plant in Oswego, N. Y. and in 1931 came to the general offices in New York as assistant to Raymond Newcomb, sales manager. At Mr. Newcomb's death in 1932, Mr. Addams assumed the full duties of the office. In 1936, Mr. Addams became Executive Vice-President and Treasurer and was elected a Director of the Corporation. He was made Chairman of the Executive Committee in 1943.

**Lester O. Stearns** of Cleveland, Ohio has joined **York-Shipley, Inc.** as manager of the Residential Division and will supervise all sales of York-Shipley residential and commercial oil-fired heating equipment. Prior to joining York-Shipley, Mr. Stearns was owner and director of Stearns Supp'y Company, Cleveland tool sales concern.


Insulation on pipes, ducts and boilers must be protected by lagging material. But you need no longer spend the time or the money to have this material sewn . . . not when Arabol Lagging Adhesive is used.

This adhesive holds the canvas, asbestos, fiberglas or other covering firmly in place; dries in 4 to 6 hours; *leaves a sized finish.* The lagging material is neat-looking and fully protected—without the use of paint. (You can always add one coat for appearance, if you so desire.)

Maintenance is simplified—grease, oil, soot and dirt wash off easily. And the adhesive is vermin-proof . . . fire-retardant, too.

Arabol Lagging Adhesive has successfully passed rigorous tests by independent laboratories. The results show that it retains its adhesive powers despite exposure to extreme temperatures, to immersion in water, and to live steam.

Write us today for detailed facts and figures. Don't place open specifications on lagging work – insist on Arabol Lagging Adhesive. You can depend on it to fill your most exacting requirements for both utility and appearance. Also, ask about our cork cement for adhering cork to cork on refrigerator lines.

**THE ARABOL MANUFACTURING CO.**

*Executive Offices:* **110 East 42nd St., New York 17, N. Y.**

**CHICAGO—54th Ave. & 18th St. SAN FRANCISCO—30 Sterling St.**

*Branches in Principal Cities. Factories in Brooklyn, Cicero, San Francisco*

*Adhesives?...* **ARABOL!**

Although the drain water that leaked on this woman's washing is gray, she sees *red*. She'll tell the plumber what she thinks of him.

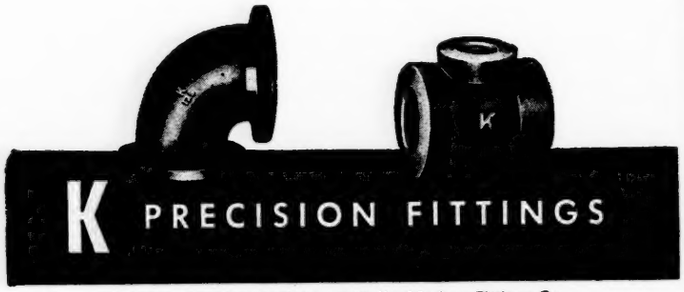
Smart plumbers don't install fittings which are likely to have hidden defects. They spend a trifle more for the best, thus avoiding costly call-backs and embarrassing call-downs.

The "K" line of precision-cast, precision-machined, minutely inspected fittings includes . . .

Standard and Extra Heavy Cast-Iron Screwed Fittings
Standard and Extra Heavy Companion Flanges
Standard Flanged Cast Fittings
Drainage Fittings

*CATALOG ON REQUEST*

**KUHNS BROTHERS CO.**
DAYTON 1, OHIO




Combined market facilities at Malleable Iron Fittings Co., Branford, Conn., and at Kuhns Bros. Co., Dayton, Ohio

The Jet Heet furnace, newly developed residential warm air central heating unit using heat transfer principles of the jet propulsion engine (H&V:2:47:p99), will be manufactured and distributed by **Jet-Heet, Inc.**, recently formed corporation backed financially by American Research and Development Corp. Jet-Heet, Inc. has bought out Kerns and MacCracken Corp., the company originally formed to develop the furnace. Officers of Jet-Heet, Inc. are: **C. D. MacCracken**, president and inventor of the furnace, and **Robert W. Lade**, secretary-treasurer.

**Harvey-Whipple, Inc.**, manufacturer of **Master Kraft** oil heating equipment, announces the addition of **Harold I. Johnson** to the production engineering department. Mr. Johnson came to Harvey-Whipple from General Motors, Chevrolet Aviation Division, Buffalo, N. Y., where he was engaged in the development, testing, and production of jet aircraft engines.

Promotions in the service department of **Frigidaire Division of General Motors Corp.** in Dayton are announced. **E. E. Landis**, assistant service manager, has been promoted to service manager, succeeding **Paul V. Sprout** who has been appointed branch manager for the Frigidaire Sales Corporation in Albany, N. Y. **H. E. Van Scoyk**, who has been in charge of service technical, will continue to serve as assistant service manager, but with broader responsibilities, Mr. Lehman explained. In addition to his regular duties, Mr. Van Scoyk will assume the responsibilities formerly hand'ed by Mr. Landis.

**Fred C. Boyce** was re-elected president of the **D. J. Murray Mfg. Co.**, Wausau, Wis., at the annual meeting April 24. With him the following officers were also elected: **M. P. McCullough**, vice-president; **C. E. Staky**, executive vice-president and general manager; **A. W. Plier**, secretary and assistant general manager; **J. S. Alexander**, treasurer.

**W. E. Curran** has been named general manager of **Rheem Manufacturing Co.** He is also a vice-president and director. Joining Rheem in 1942, Mr. Curran was made vice-president in charge of production in 1943, and in February of 1946 was elected a director. He will continue to make his headquarters in New York.

**Roy W. Maze** has been appointed public relations director of **The Marley Co., Inc.**, manufacturers of nozzles, cooling towers and other water cooling equipment. Mr. Maze entered the Marley Co. in November, 1946, and succeeds Charles B. Briggs, Jr. who is now production manager of the Kansas City, Kansas plant. Mr. Maze received a B.S. degree in mathematics and physics from the College of Emporia at Emporia, Kansas and his Masters degree from the Kansas State College of Agriculture and Applied Science at Manhattan, Kansas. Prior to his service with the Marley Company, he served as director of technical publications for 3 years at the Aireon Manufacturing Corp. in Kansas City.

*R. W. Maze*

**John T. Elwood** is the new district engineer of the St. Louis office of **Vapor Car Heating Co., Inc.**, which manufactures heating and temperature control equipment for railroads, buses, airplanes and other forms of transportation.

*(Continued from page 116)*

Los Angeles in March of the Water Heating Council of the Pacific Coast Gas Association.

• **CHARTS.**—Submitted in a report by R. D. MacMahon of the Southern California Gas Co., Los Angeles, chairman of the council's special committee on water heater sizing, the data, which were hitherto available only in limited quantities, were regarded as sufficiently inclusive to warrant the association's authorizing the committee to proceed with the preparation of hot water heater sizing charts for commercial users of large volumes of hot water.

The action represented an extension of the association's water heater sizing and educational program from the domestic into the commercial field. It was taken after a report given by Clyde H. Potter of Los Angeles, council chairman, had disclosed the exceptional success the association had experienced with domestic water heater sizing charts which it prepared and introduced two years ago to encourage the sale and use in homes of domestic gas water heaters with a minimum capacity of 30 gallons.

The MacMahon committee was authorized by the council to proceed with the preparation of a booklet which will contain a general presentation of gas water heating equipment, basic suggestions for the installation of volume heating equipment, sizing charts indicating recommended minimum hot water requirements for apartments, hotels, courts and large residences, and an individual chart for determining restaurant hot water requirements based on average needs as disclosed by surveys conducted by the committee.

## NEWS BRIEFS

• As of May 10, 89 companies have taken a total of 139 booths at the 5th All-Industry Refrigeration and Air Conditioning Exposition to be held in Cleveland January 26 to 29, 1948.

• Solid Fuels Administration for War will be liquidated as of June 30, 1947 by Executive Order of the President.

• An air conditioned basement provides 12,000 sq ft of added rentable office space for Walter J. Salmon at 500 Fifth Ave., New York City. This former waste and storage space has paid off so well that Mr. Salmon is considering air conditioning the sub-basement, another floor below, for similar use.

• Rent control has been transferred from OPA to the Office of the Housing Expediter under Frank R. Creedon effective May 4 by Executive Order of the President. Approximately 6,100 OPA employees are transferred in the deal.

• Thirty-five illustrated lecture meetings on dust and fume control in anthracite mines were presented in March and April by R. Emmet Doherty, special engineer for Anthracite Institute, to 1,500 producing company and union representatives.

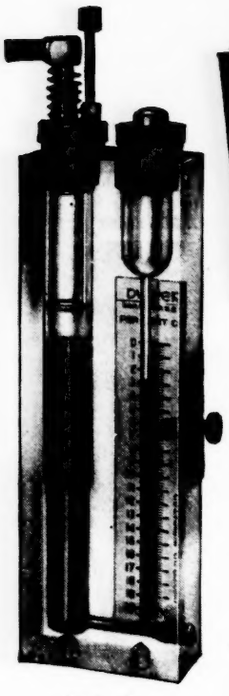
• Total new construction put-in-place this year is now expected to be between $12 and $13 billion compared

● Speed piping installations this efficient, easy, economical way . . . make "on the job" bends in pipe up to 4½" with a GREENLEE Hydraulic Bender.

With a GREENLEE *one man* makes smooth, accurate, uniform bends in a few minutes. You save greatly through elimination of manufactured bends, many fittings, and the work of threading them. And, in timesavings alone, the GREENLEE pays for itself quickly.

Simple to operate, easy to carry, set up, and shift from job to job . . . lets you bend pipe exactly where and when you want it. Ideal for radiant heating jobs. For complete details write for free folder S-121. Greenlee Tool Co., Division of Greenlee Bros. & Co., 2326 Twelfth Street, Rockford, Illinois.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN



Scientific Accuracy IN ANYONE'S HANDS

DWYER TRANSPARENT

**$CO_2$ INDICATOR**

Dwyer Transparent $CO_2$ Indicator (Model 800) insures *true* readings, even by inexperienced operators, because: (1) trapping of over-pressure is impossible due to Dwyer expansion bladder feature and (2) no pre-absorption error—test sample sealed from active absorbent solution. Its simple design, unbreakable transparent body, durable construction gives longer life, and a higher degree of dependable, scientific accuracy. Also available in Combination Test Set with Draft Gage and Thermometer in handy carrying case.

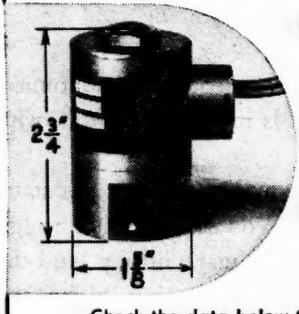
*Order from Your Jobber Now!*

**F. W. Dwyer Mfg. Co.**

**309 South Western Avenue, Chicago 12, Ill.**



APPLICATIONS UNLIMITED FOR ALLIED *Solenoid Valves*




Check the data below to find where an Allied Control Three-Way, Two-Position Solenoid Valve will fit into your product design. Made of stainless steel, they safely and economically control or meter the flow of practically all fluid and gaseous media.

**THREE STANDARD MODELS**

| Three way | two position |
|---|---|
| Two way | normally open |
| Two way | normally closed |

Pressure range 5 to 250 psi
Dimensions 2¾" high x 1⅝" dia.
Impregnated coils withstand moisture and condensation
Soft insert seats prevent leakage
Spring loaded for positive action
Stainless steel parts highly resistant to corrosion and wear
Power consumption 10 watts max.
Pipe connections to specification.
Also many special valves for handling pressures from 5 to 850 psi

For complete details and catalog write to

**ALLIED CONTROL VALVE DIV.**
The Skinner Chuck Co.
**136 BELDEN AVENUE, NORWALK, CONN.**


with an earlier estimate of $15 billion by the Department of Commerce. The 1946 total was $10 billion.

• A research job into the printed source material available for preparing and revising local building codes has been completed by American Standards Association in cooperation with the National Bureau of Standards. Interested groups can obtain the listing of 160 documents from ASA.

• A 5-months ban on the use of gas or electricity for heating purposes was invoked May 5 for all British homes. Emanuel Shinwell, Minister of Fuel and Power, hopes to save 2.5 million tons of coal this way.

• The Association of American Railroads will extend into 1948 the tests which their Bureau of Refrigerator Car Research is conducting to determine practicable improvements in such cars.

• A crippled victory ship, the *Plymouth Victory*, with a hold full of cattle for China, rigged sails to force air into the hold while the ship was towed for two days from Acapulco, Mexico, to Long Beach, Calif. Boiler trouble had stopped all ventilation.

## *Getting Personal*

This is **Leo T. Parker** (*Legal Status of Independent Contractors*, page 99) a publicity-shy attorney. His photograph was not available at the time his biography was published on page 138 of the April, 1947 issue. A member of the Ohio Bar, he is also admitted to practice patent law before the U. S. Patent Office. For many years Mr. Parker has been a regular contributor to a large variety of business papers, writing on legal matters of interest to specialized technical and engineering fields. At present, HEATING AND VENTILATING has a number of his articles scheduled for early publication.

*Leo T. Parker*

**James G. DeFlon** (*Evaluating Performance of the Mechanical Draft Cooling Tower*, page 73) is the chief cooling tower development engineer and trouble shooter for The Fluor Corp., Ltd.

Born in Calgary, Alberta, he moved at an early age to Los Angeles, Calif., and completed his public school education there. He majored in chemical engineering at the University of Southern California where he graduated in 1938.

*James G. DeFlon*

Upon graduation, he went to work in Kettleman Hills and spent three years there doing about every conceivable job in and around an oil refinery.

In 1941 he came to Fluor and in rapid succession was employed by the drafting department, yard office, cooling tower department, and finally the manufacturing department. His work on experimental towers and in field tests on atmospheric and mechanical draft cooling towers was important to the company's evolution of the Counterflow tower. Beside his design and test work he is a trouble shooter to investigate the reason why some towers fail to perform and recommend changes to remedy the situation.

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## COMING EVENTS

JUNE 16-19, 1947—Semi-annual meeting of The American Society of Mechanical Engineers, Stevens Hotel, Chicago, Ill. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York, N. Y.

JUNE 16-19, 1947—Annual meeting, Stoker Manufacturers Association, Lookout Mountain Hotel, Lookout Mountain, Tenn.

JUNE 23-25, 1947—Applied Mechanics Division, American Society of Mechanical Engineers, at Schenectady, N. Y. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York, N. Y.

JUNE 24-27, 1947—38th Annual meeting of the National District Heating Association, The Chalfonte-Haddon Hall Hotel, Atlantic City, N. J. Further details from the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa.

SEPT. 1-4, 1947—Fall meeting of The American Society of Mechanical Engineers, Hotel Utah, Salt Lake City, Utah. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York, N. Y.

SEPT. 8, 1947 (week of) — Annual meeting, Instrument Society of America, Stevens Hotel, Chicago, Ill., in connection with exhibit.

DEC. 1-5, 1947—Annual meeting of The American Society of Mechanical Engineers, The Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York, N. Y.

DEC. 8-10, 1947—Annual convention, American Society of Refrigerating Engineers, Hotel Traymore, Atlantic City, N. J. Acting secretary, M. C. Turpin, 40 W. 40th St., New York 18, N. Y.

JAN. 26-29, 1948 — Fifth All-Industry Exposition of the Refrigeration Equipment Manufacturers Association, at Cleveland Public Auditorum, Cleveland, Ohio.

FEB. 1-4, 1948—54th Annual meeting, American Society of Heating and Ventilating Engineers, to be held in New York in conjunction with the 8th International Heating and Ventilating Exposition. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York, N. Y.

JUNE 9-11, 1948 — Spring meeting, American Society of Refrigerating Engineers, New Ocean House, Swampscott, Mass. Acting secretary, M. C. Turpin, 40 W. 40th St., New York 18, N. Y.

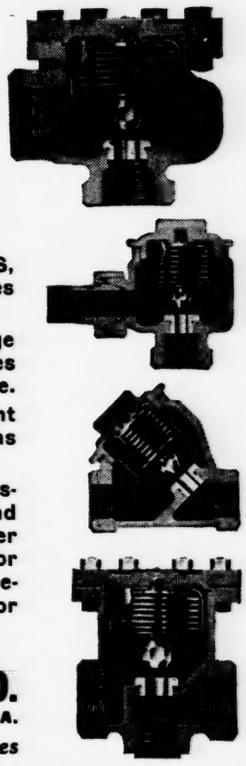
OCT. 4, 1948 (week of)—Annual convention, American Gas Association, Atlantic City, N. J., Arthur Q. Smith, publicity director, American Gas Association, 420 Lexington Ave., New York 17, N. Y.


*Catalog 444 Shows How to*

**CUT HEAT-UP TIME**

OF

**Unit Heaters and Pipe Coils**



Here are 3 of the features of Nicholson thermostatic steam traps, which account for their record of savings in heat-up time:

1) LARGER VALVE ORIFICES, resulting in 2 to 6 times average discharge capacity.
2) NO AIR BINDING, discharge air and non-condensible gases as efficiently as condensate.
3) NO WATER-LOGGING, slight temperature difference opens valve.

5 types: size ¼" to 2"; pressures to 225 lbs. Weight- and piston-operated traps for higher pressures and larger pipes. For Nicholson's complete, service-tested line see Catalog 444 or Sweet's.

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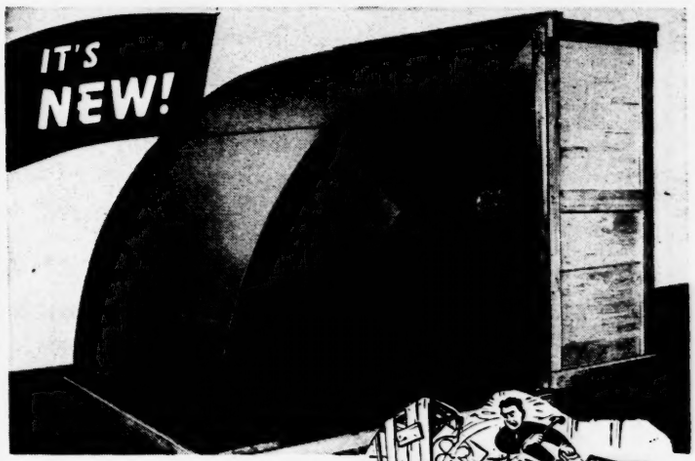
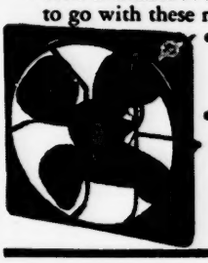
199 OREGON ST., WILKES-BARRE, PA.
*Valves★Traps★Steam Specialties*




*WHY DO IT THE HARD WAY?*

- No need to clutter up the attic with make-shift carpenter jobs which just barely pass as suction boxes when you make those attic fan installations. Sell the simplified Health-Aire Suction Box that takes only a few minutes to install. Streamlined and light in weight, the Health-Aire Suction Box looks attractive and keeps fresh air flowing through homes or business places without loss of air or wasted power.
- Also available . . . Health-Aire ceiling shutters, designed especially to go with these new rust-proof aluminum Suction Boxes.



- Sell your customers the *easy* way . . . *easier* assembly, *easier* installation, greater air-conditioned comfort. It will pay you.
- *There is a Health-Aire Fan for every need . . . ideal running mates for Health-Aire Suction Boxes.*

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